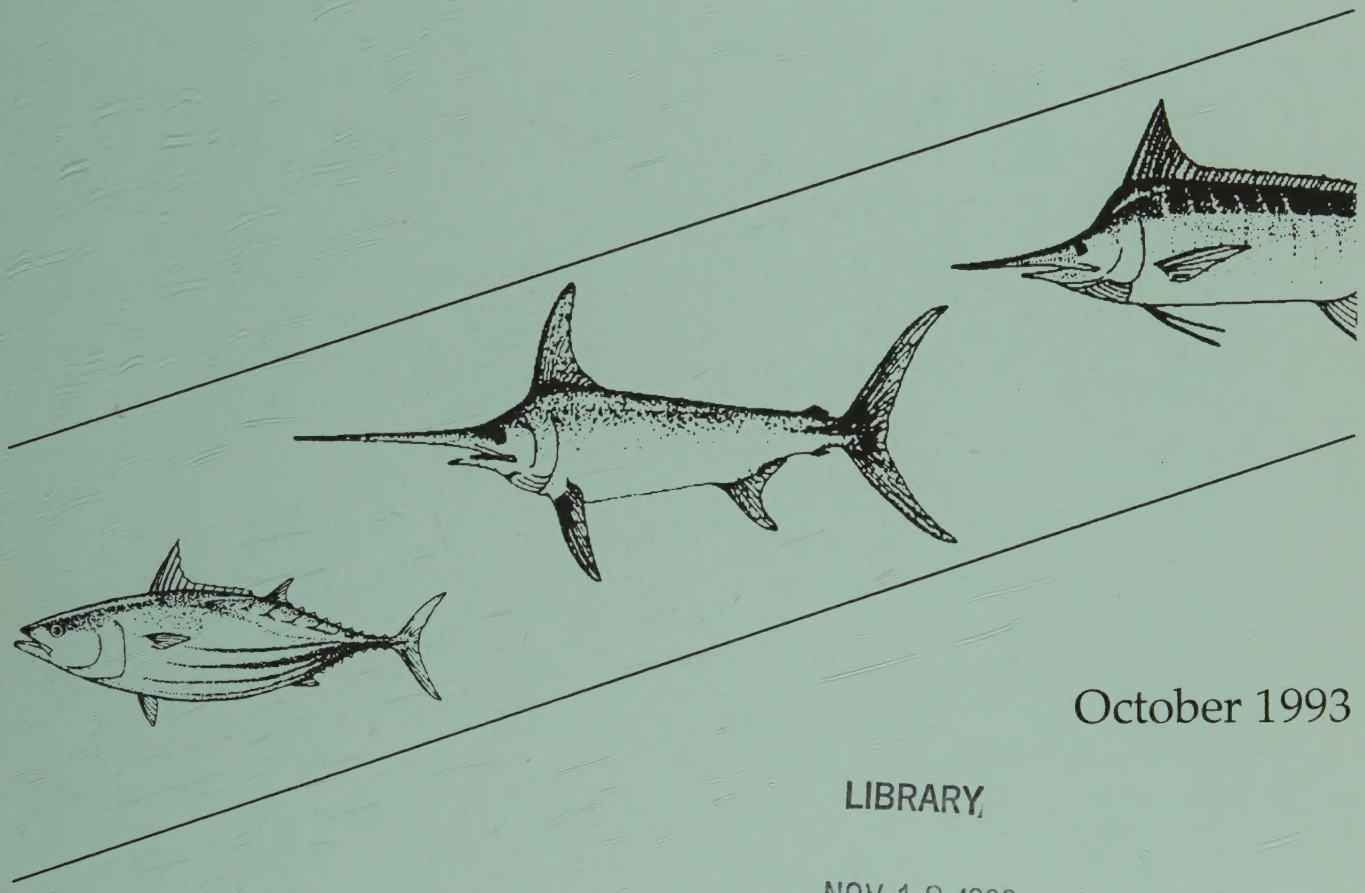
Pelagic Fisheries of the Western Pacific Region

1992 Annual Report



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Pelagic Fisheries of the Western Pacific Region

1992 Annual Report

October 1993

Prepared by the Pelagics Plan Team and Council Staff

for the

Western Pacific Regional Fishery Management Council
1164 Bishop Street, Room 1405, Honolulu, Hawaii 96813

A report of the Western Pacific Regional Fishery Management Council pursuant to National Oceanic and Atmospheric Administration Award No. NA17FC0062-02.

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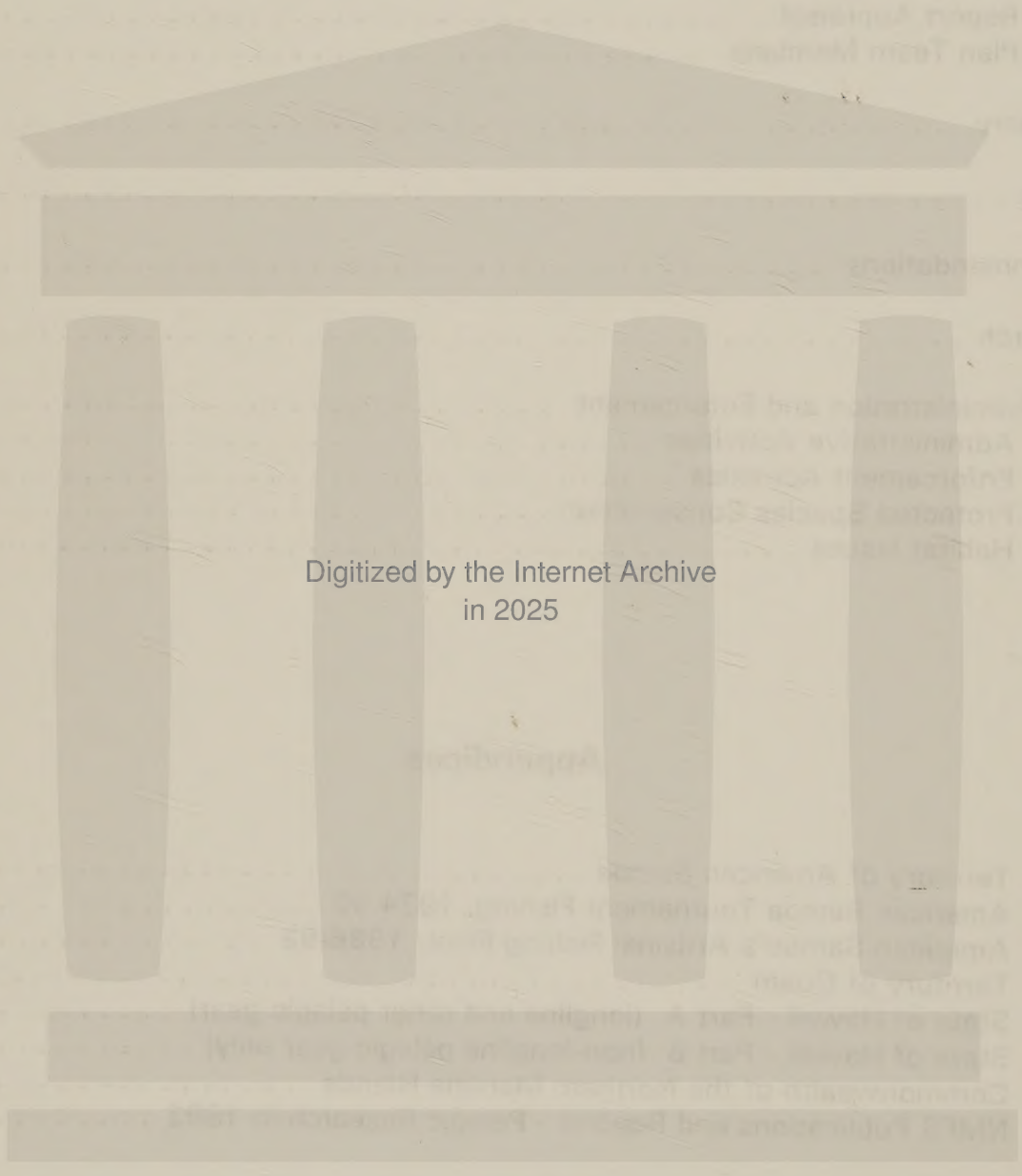

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Introduction

Background

The Fishery Management Plan for the Pelagic Fisheries of the Western Pacific Region (FMP) was implemented by the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) on March 23, 1987. The Western Pacific Regional Fishery Management Council (WPRFMC or Council) developed the FMP to manage the pelagic resources covered by the Magnuson Fishery Conservation and Management Act of 1976 and occurring in the US Exclusive Economic Zone (EEZ) around American Samoa, Guam, Hawaii, the Northern Mariana Islands, and other US possessions in the Western Pacific Region (Johnston Atoll, Kingman Reef & Palmyra Island, Jarvis Island, Howland and Baker Islands, and Wake Island).

The objectives of the Pelagics FMP were revised in 1991 (by Amendment 1 to the FMP). The abridged objectives are to:

- Manage fisheries for management unit species to achieve optimum yield.
- Promote domestic harvest of, and domestic fishery values associated with, Pacific pelagic management unit species (PPMUS[1]), e.g., by enhancing the opportunities for satisfying recreational fishing experience, continuation of traditional fishing practices, and domestic commercial fishermen to engage in profitable operations.
- Diminish gear conflicts in the EEZ, particularly in areas of concentrated domestic fishing.
- Improve the statistical base for conducting better stock assessments and fishery evaluations.
- Promote formation of regional/international arrangements for assessing and conserving PPMUS throughout their range.
- Preclude waste of PPMUS associated with longline, purse seine, pole-and-line or other fishing operations.

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[1] The Magnuson Act was amended to allow the inclusion of tunas in US fishery management authority as of January 1992. In the Pacific, tuna management is the responsibility of the regional fishery management councils. The classifications in this table are per Amendment 6 to the Pelagic Fisheries of the Western Pacific Region FMP, effective November 27, 1992. Pacific pelagic management unit species (PPMUS) includes former pelagic management unit species and tunas.

- Promote domestic marketing of PPMUS in American Samoa, Guam and Hawaii.

The Pacific pelagic management unit species are:

Common Name	Scientific Name
Mahimahi (dolphin fishes)	*Coryphaena* spp.
Wahoo	*Acanthocybium solandri*
Blue and Black marlin	*Makaira* spp.
Striped marlin and shortbill spearfish	*Tetrapterus* spp.
Sailfish	*Istiophorus* spp.
Swordfish (broadbill)	*Xiphias gladius*
Requiem sharks (oceanic species)	family Carcharhinidae
Thresher sharks (oceanic species)	family Alopiidae
Mackerel sharks (oceanic species)	family Lamnidae
Hammerhead sharks (oceanic species)	family Sphyrnidae
Tunas (bigeye, yellowfin, albacore, ...)	*Thunnus* spp.
Skipjack tuna	*Katsuwonus pelamis*
Kawakawa (and related spp.)	*Euthynnus* spp.
Frigate tuna	*Auxis* spp.
Dogtooth tuna	*Gymnosarda* spp.
Slender tuna	*Allothunnus fallai*
Mackerel	*Scomber* spp.

Miscellaneous pelagic species caught in specific areas will be identified in the appendices (island modules). Non-tuna PPMUS are sometimes referred to as "other PPMUS" in this report. This term is equivalent to the PMUS (Pelagic Management Unit Species) used in previous annual reports, before tunas were included in the management unit.

The PPMUS are caught with trolling gear, handlines, tuna and swordfish longlines, and pole-and-line gear (skipjack tuna baitboats). They are caught in oceanic and insular pelagic waters. Most of these species are considered to be epi-pelagic because they occupy the upper most layers of the pelagic zone. All are high-level predators in the trophic sense. Pelagic fisheries for PPMUS are among the most important, if not the dominant, Pacific island fisheries.

The FMP requires the Council's Pelagic Plan Team (Team) to prepare an annual report on the status of the pelagic fisheries taking place in each of the island areas served by the Council (American Samoa, Guam, Hawaii, and Northern Mariana Islands), evaluate the effectiveness of the FMP in meeting its goals and objectives, and make recommendations for future management and administrative action.

Report Content

This report contains fishery performance data from each of the four island groups through 1992, interpretations of trends or important events occurring in the fisheries, and recommendations.

This report was prepared using reports submitted by the following agencies:

- Territory of American Samoa, Department of Marine and Wildlife Resources
- Territory of Guam, Division of Aquatic and Wildlife Resources
- State of Hawaii, Division of Aquatic Resources
- Commonwealth of the Northern Mariana Islands, Division of Fish and Wildlife
- National Marine Fisheries Service, Southwest Region (including Southwest Fisheries Science Center Honolulu Laboratory, Pacific Area Office, and Office of Enforcement)
- US Coast Guard District Fourteen

As in previous years, the Hawaii report (Appendices 3 and 4) is a combination of information from the National Marine Fisheries Service and the State of Hawaii.

Report Appraisal

Report content has not changed significantly from previous years. The Team did not expand or improve on the use of fishery indicators this year.

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Summary

1. The Council took several management actions in 1992. The FMP was amended to close inshore areas around the main Hawaiian Islands and Guam to longline fishing, adjust the Hawaii closure seasonally, and add tunas and related species to the management unit. See Administrative Activities (below) for details.

2. The Hawaii fishery for PPMUS produced the highest landings (27.4 million lb) and revenue ($54.2 million) of all the island groups in the Council's jurisdiction. Guam PPMUS landings and revenue (0.69 million lb, $0.49 million) were next highest, followed by the Northern Marianas (0.16 million lb, $0.31 million), and American Samoa (0.11 million lb, $0.14 million). In Guam and Hawaii, non-tuna landings exceeded tuna landings. In addition, Guam showed a decline in total pelagic landings relative to 1991, while landings increased in Hawaii, American Samoa and the Northern Marianas.

3. In American Samoa, none of the indicators showed any significant change in the status of the resources. Commercial landings increased from 1990-91 levels, but have not reached pre-1990 levels. Although the number of boats declined slightly, CPUE for skipjack increased, contributing to the higher 1992 landings. Prices for non-tuna PPMUS rose, but still failed to keep up with inflation (while prices for tunas have). The local fleet continues to face competition from fish purchased from the distant-water pelagic fleet which normally come to Pago Pago to sell their fish to the canneries. In the last several years, there has been increased imports of fresh fish from Tonga and Western Samoa, as well, that now account for the majority of fresh bottomfish and reef fish species available in local markets. While direct market competition for pelagic species has been less dramatic, the prospect of potential competition (evidenced by the influence of bottom and reef species) has discouraged some local fishermen from making fishing trips.

   Tournament data for 1974-92 are presented in supplementary Appendix 1.A. The data show a high variability in catch rates and sizes of fish. Tournament data collection has, however, been inconsistent but is improving. A detailed analysis of the artisanal fishing fleet is also presented in supplementary Appendix 1.B. A general decline of fishing activity by the local fleet has been observed in recent years. Of the 77 boats that left the fishery since 1986, 13 (17%) were damaged by hurricanes. The rest have left for economic or other reasons, and have generally not been replaced.

4. In Guam, none of the indicators showed any significant change in the status of the resources, and the pelagic fishery continued to expand, particularly the charter component. On the negative side, average prices and revenue per trip continued to decline due, at least in part, to the entry of tunas from

foreign vessels through irregular marketing channels and other marketing problems. The marlin catch continued to increase with the growth of the charterboat fleet. Yellowfin tuna landings exceeded skipjack landings for the first time. The average size of yellowfin tuna in the International Fishing Derby continued its gradual increase, following a decline in previous years.

5. In Hawaii, none of the indicators demonstrated any adverse change in the status of the resources. In 1992, total landings and nominal revenue for all pelagic species increased slightly from 1991. Catch rates for major pelagic species caught by surface fisheries declined in 1992, except for troll-caught yellowfin tuna and handline yellowfin and bigeye tuna; catch rates in these fisheries increased. Swordfish continued to be the dominant species in the pelagic fishery and exceeded combined tuna landings. Landings of mahimahi decreased slightly. Almost 60% of all longline trips were wholly or partly outside the EEZ. Blue marlin continued to be caught by longlines, as did striped marlin, but catches of the latter decreased greatly in 1992.

6. In the Northern Mariana Islands, the pelagic fishery was in good economic health, although commercial effort has declined moderately since 1983. The charterboat industry is expanding rapidly due in part to the Smiling Cove marina development. Commercial landings for the last several years were down somewhat due to poor skipjack tuna seasons. Skipjack landings declined again in 1992 to a record low. Landings of mahimahi decreased from a record high in 1991, but was still higher than wahoo or blue marlin. Wahoo landings were high, about ten times 1991 levels.

7. Total 1992 Hawaii landings for all pelagic species (27.4 million lb) increased just 2% from 1991, while the 1991 landings were 52% higher than 1990. Swordfish landings (10.9 million lb) were up 27%, compared to the 129% increase in 1991 and 479% increase in 1990. Striped marlin landings were down 27%. Mahimahi landings were down 15% from 1991, but matched the six-year average. Tuna landings (9.5 million lb) were down 14%, with catches of all species, except albacore, lower than in 1991.

   Guam landings of all pelagics (0.69 million lb) decreased by 16%, following a 13-year peak in 1991. The decline was due mostly to decreased catches of mahimahi, which were exceptionally high in 1991. The 1992 landings were slightly lower than the 12-year average.

   Landings of all pelagics in the Northern Marianas increased 8% to 0.16 million lb, but skipjack tuna landings, the largest component of the landings in the Northern Marianas, declined again (by 29%) in 1992, representing a 69% decline since 1988.

American Samoa pelagic landings increased 18% to 0.11 million lb, but the fishery is still suffering from the reduction in the fleet and competition from seafood imports.

8. In 1992, the Hawaii longline fleet landed 21.2 million lb of pelagic fish, maintaining a steady increase since 1987. Recently, longliners caught most of the billfish (including swordfish) landed in Hawaii, including nearly all of the swordfish and striped marlin, and more than half of the blue marlin. Roughly 69% of the longline landings (approx. 14.7 million lb) were billfish (almost all were swordfish), compared with 0.7 million lb (16%) landed by the troll and handline fisheries (most were blue marlin). Hawaii's troll and handline landings of pelagics decreased in 1992 to 4.4 million lb, slightly below the six-year average of 4.6 million lb. Wahoo was the only major species caught predominantly by troll and handline vessels.

9. The Pelagics FMP was originally established because of concerns regarding foreign longline catches within the US 200-mile EEZ, which were highest in 1976 at 8.6 million lb, including 1.1 million lb of billfish. Domestic longline landings in 1992 both within and beyond the EEZ were 2.3 times greater than the foreign 1976 catch within what was to become the EEZ, with billfish alone totaling 12.9 million lb, or 11.7 times greater than the US catch.

10. The swordfish longline fishery in Hawaii began in 1989 with landings estimated of 0.6 million lb, increasing to 3.4 million lb in 1990, and to 10.9 million lb in 1992. The average size of swordfish rose dramatically in 1992, perhaps due to new areas being fished by longliners. Swordfish comprised the largest proportion of the total non-tuna landings in Hawaii for the third consecutive year (73% in 1992, 62% in 1991, and 38% in 1990). Swordfish landings from non-longline gear were negligible.

11. In Hawaii, blue marlin landings (1.3 million lb.) were at the six-year average from 1987-92, registering a slight 13% decrease from 1991. Longline accounted for 56% of the total blue marlin landings. Guam landings of blue marlin declined only slightly (2%), ranking third behind mahimahi and skipjack tuna. Marlin landings in the Northern Marianas (presumably mostly blue marlin) were much higher in 1992 (400% over 1991). In American Samoa, blue marlin landings were 40% lower than 1991, but still higher than the ten-year average from 1982-1991.

12. The catch rate of blue marlin in the Hawaii troll fishery declined in 1992, but remained higher than the period from 1983-87. In Guam, blue marlin troll catch rates declined from a record high 1990-91 levels, although catch rates have increased slowly since 1980. The catch rate of blue marlin in the American Samoa troll fishery decreased slightly, but remained higher than

average. In the Northern Marianas, the 1992 marlin catch rate increased to a new record, higher than the previous peak in 1989.

13. The average size of blue marlin caught by the Hawaii longline fishery was smaller than troll/handline caught fish, for the fifth straight year. The average size of blue marlin in the Guam international derby declined again, setting a new low.

14. Striped marlin landings ranked third among the non-tuna PPMUS in Hawaii (after swordfish and blue marlin), where it accounted for 7% of the commercial landings of non-tuna PPMUS. The 1992 landings of 1.1 million lb was 23% lower than 1991 landings and lower than the 1987-1992 average. Striped marlin is regarded as a secondary target species (after bigeye tuna) in the winter longline fishery, and it ranked second after swordfish in total longline landings of billfish. Troll and handline fisheries caught few striped marlin, and the species rarely appears in the domestic landings from other management areas.

15. Shortbill spearfish made up 3% of the PPMUS landings in Hawaii, and rarely appeared in the landings reported for other management areas. Black marlin and other miscellaneous billfish were rare in all fisheries.

16. Sailfish landings were insignificant in all management areas.

17. Mahimahi landings (1.1 million lb) made up 6% of the 1992 non-tuna PPMUS landings in Hawaii, a 13% decrease from 1991. The longline fishery accounted for 55% of the 1992 landings. The troll catch rate in Hawaii decreased to about 1990 levels, but it was higher than the 13-year average. In Guam, mahimahi landings decreased to 136,421 lb, or 32% of non-tuna PPMUS landings. The trolling catch rate also decreased dramatically. Similarly in the Northern Marianas, mahimahi landings decreased to 21,462 lb, or 48% of the non-tuna PPMUS landings. The trolling catch rate decreased 45% from 1991, but remained higher than 1990. In American Samoa, mahimahi landings (1,987 lb) increased from 1991, but they continued a decline since 1988.

18. Wahoo landings in Hawaii for 1992 (ca. 400,000 lb) decreased 21% from 1991, equaled the 1987-92 average, and ranked sixth among the PPMUS. The trolling catch rate data for Hawaii indicate that wahoo abundance has remained fairly steady since 1979. In Guam, however, wahoo landings (113,000 lb) increased greatly (59% from 1991), represented 29% of the non-tuna PPMUS landings, and were the highest since 1985. Catch rates followed a similar trend. In the Northern Marianas, wahoo landings (ca. 14,000 lb) were also very high (up more than 1,000% from 1991), setting a new record since 1985. In American Samoa, wahoo landings (3,400 lb)

also set a new record. The catch rate was also at a new peak. As in the Northern Mariana Islands, the catch rate followed a trend similar to that of landings, suggesting that wahoo abundance is higher than earlier years. The similarity in landings and catch rate trends in Guam, the Northern Marianas, and American Samoa is noteworthy.

19. Reported Hawaii shark landings in 1992 were higher than the recent average. The 1992 increase was probably a result of better reporting (new federal longline logbooks) than anything else. The lack of reliable historical data makes analysis difficult. There is little commercial or sport fishing interest in sharks compared to non-tuna PPMUS, but finning and/or sale of shark meat for human consumption does occur in the Hawaii fishery. Even with the federal logbooks, data on shark catches, species composition and catch disposition are insufficient.

20. Troll fisheries dominated the domestic fisheries in American Samoa, Guam and the Northern Marianas, in contrast to Hawaii where the longline sector caught more PPMUS than the other sectors for the fourth consecutive year. Growing charter fishing businesses in Guam and Northern Marianas contributed heavily to troll fishing effort. There were no domestic longliners operating in American Samoa, Guam, or Northern Marianas in 1992, and pelagic handline fishing has not been established in any areas other than Hawaii.

21. In Hawaii, the inflation-adjusted ex-vessel revenue from the sale of pelagic species for the longline fishery has been increasing, and at a rate faster than landings. In contrast, revenue of the troll and handline fisheries has been decreasing and has not kept up with inflation, particularly in recent years. In American Samoa and Guam, inflation-adjusted prices have remained unchanged since 1980, and inflation-adjusted revenues show a declining trend with time for both PPMUS and all pelagics combined. In the Northern Marianas, 1992 inflation-adjusted price of PPMUS decreased slightly, but prices in 1990 and 1991 were still above the prices of earlier years. Inflation-adjusted revenues per trip, however, showed a marked downward trend for all pelagic species, although PPMUS revenues have increased in recent years.

22. Fishing effort for the combined pelagic fisheries in Hawaii remained at a high level in 1992. The number of longline vessels increased from around 40 in 1983-87 to nearly 140 in 1990. Then, in 1991, the number of active vessels declined to 111, as boats left the fishery and could not be replaced under the rules of the moratorium on new participants. In 1992, 123 vessels were active in the fishery, but the number of trips decreased by 22% from 1,665 in 1991 to 1,299 in 1992. The number of trips by the troll fishery decreased 13% to 20,109, but still was higher than the 1979-

91 average of 16,379. The number of trips taken by skipjack tuna baitboats after having established a new low in 1990, recovered only moderately in 1991 and 1992. The number of handline trips continued a decreasing trend since 1987, with a 10% drop from 1991.

In Guam, the number of boats fishing remained at a slightly lower than the high established in 1990, but remained above the long-term average. The number of trips (29%) and hours fished (20%) increased substantially from 1991 which represents a new peak in activity, although the time spent fishing per trip decreased.

In American Samoa, the number of boats in the pelagic fishery continued to decline from the high in 1986. The number of hours and trips declined slightly, remaining close to overall 1990-92 levels, and much lower than 1989 levels.

In the Northern Marianas, the number of fishermen landing any pelagic fish was much higher (42% increase) than 1991 and represents a new record. The number of trips landing PPMUS also increased (45%) over 1991, and represents another new record. The reported increases may be due partly to improved data collection.

23. In 1992, US purse seine vessels harvested 14,368 short tons of tuna within the US EEZ of the Western Pacific Region. This catch consisted of 3,356 tons of yellowfin tuna and 11,012 tons of skipjack tuna. The detailed locations of these catches was not available.

24. In 1992, no permits were requested by any foreign nation to fish in the US EEZ of the Western Pacific region.

Issues

With the addition of tunas and related species to the FMP, and recent changes in the region's pelagic fisheries, the Team calls attention to the following issues that may require Council action in the near future.

1. The region's pelagic fisheries harvest large tunas with generally high commercial values, as well as small tunas with relatively high social or subsistence value, but lower commercial value. Generally, the inshore surface gears (troll and handline) take smaller fish than offshore gear (mostly longline). Because a commercial pelagic handline fishery is now developing that specifically targets small bigeye and yellowfin tuna found in association with seamounts and weather buoys located off the Hawaiian Islands, there is concern about the increased catch of immature tuna.

Two concerns are being voiced. First, will a large harvest of immature fish within the Hawaiian EEZ cause a decline in the harvest of large adults in all Hawaii fisheries? If the immature fish eventually provide the recruits to the large adult fishery, then increased harvest of small fish may have a measurable effect on the fishery. Second, these small fish are easy to catch and often flood local markets, often resulting in lower ex-vessel prices. Consumers may benefit from the lower prices, but profit margins decline for fishing boats that do not increase their catches proportionately, and business is increasing at risk of failure. In addition, the oversupply of small fish has occasionally led to dumping of excess fish (wastage of the resource).

2. Estimates of total catch, fishing effort and CPUE are needed to effectively manage the region's pelagic fisheries, but decreasing funds will make it even more difficult to implement programs to collect recreational and other non-commercial catch data on a regular basis. Also, with the addition of tunas to the FMP, the domestic purse seine fishery taking tunas within the EEZs of US possessions in the Pacific may be one of the region's largest fisheries, even though harvests from the US EEZ are probably a small part of the total purse seine harvest. The US purse seine data is absolutely necessary for monitoring the total take of the region's fisheries, and obtaining such data for the Council's management programs on a regular basis is necessary.

3. The increasing catch of swordfish by longliners based in Hawaii raises concern over the status of swordfish in the central Pacific. Detailed knowledge of the status of the swordfish stock is needed. An assessment of the stock-wide status of Pacific swordfish is necessary for monitoring and management.

4. The Team is concerned over the lack of data on shark harvest and/or bycatch in the region. Although shark data are required to be reported on longline logbooks, it is not certain if sharks that are caught, finned, and disposed of at sea are adequately reported. Species identifications are also commonly inadequate. Since most sharks have low reproductive rates and long gestation periods, they are highly sensitive to fishing pressure. Data on volume of catch, CPUE, species, size, and disposition of sharks are needed.

5. The long-ranging, Hawaii-based longline fleet interacts with protected species such as seabirds, turtles and marine mammals. The NMFS issued a biological opinion regarding the Pelagics FMP in June 1993, resulting from an internal consultation required under Section 7 of the Endangered Species Act. The opinion outlined the need for detailed data on the amount and extent of protected species interactions and their impact on the resources. The Team supports increased data collection through observer programs to assess potential negative impacts to protected species.

Recommendations

The Plan Team offers several management recommendations regarding Western Pacific pelagic fisheries. These recommendations (and other findings and conclusions contained in the report) are the Team's alone, and do not necessarily reflect those of the Pelagics Advisory Panel, the Scientific and Statistical Committee, the Council, or the various organizations that employ the Team members. Some of the recommended tasks are ongoing. The reader is encouraged to refer to the appendices for area-specific recommendations that might not be listed in this section.

1. Take the following steps to address the use of minimum sizes for management of certain tuna species:

    a. Perform yield-per-recruit assessments of yellowfin and bigeye tuna to determine the theoretical impacts on stock dynamics of fisheries harvesting small fish.

    b. Examine the catch rates and fish size, by area, in Hawaii to address the claims that inshore fish are smaller and less abundant than before.

2. Request the Council to ask the NMFS to implement a full-scale recreational fishing survey in Hawaii, based on the techniques used in the pilot survey conducted on Oahu by the State of Hawaii (with Federal funding).

3. Continue efforts to obtain data from domestic purse seine fishing. The first priority is to obtain volume (weight of landings) and participation (number of boats). Detailed catch and effort data by precise locations will be needed to assess the status of stocks in collaboration with other countries providing data from their national fisheries. Focus on the need to make an international effort to assess stocks. Promote establishing and maintaining a central database for central and western Pacific fisheries.

4. Encourage voluntary tagging and release of pelagic species, by commercial and recreational fishermen, particularly small fish of little commercial or tournament value.

5. Improve the coverage of shark fishing by state, territory, and federal data collection programs, including catch, effort, identification to species, reporting of finning activity and harvest of fins, and disposition of sharks taken.

Research

The following summarizes some of the research related to western Pacific pelagic fisheries that was conducted in 1992 by, or in association with, the NMFS[2]. A list of publications and reports is provided in Appendix 6.

Swordfish longline research cruise, April-May 1992

A longline cruise of the NOAA ship *Townsend Cromwell* from 13 April-7 May 1992 in the southern area of the Musician Seamounts was conducted to collect biological and habitat utilization information on swordfish. Otoliths, dorsal and anal fin spines, and vertebrae were collected for use in modeling the age and growth of swordfish. Data were collected to compute formulae for converting dressed swordfish weight and measurements from commercially landed fish to whole animal dimensions. Hook timers and time-depth-temperature recorders were employed to determine time, depth, and water temperature at which swordfish took the squid bait used on the longline gear. Oceanographic profiles associated with the longline sets were also determined with the use of expendable bathythermographs (XBTs), conductivity-temperature-depth casts (CTDs), a continuously recording surface thermal-salinograph, and a continuously recording acoustic doppler current profiler (ADCP). (Robert Skillman)

Tuna longline research cruise, September 1992

A research cruise on the NOAA ship *Townsend Cromwell* in September 1992 focused on the habitat depth, hooked longevity, and vulnerability to longline fishing gear of blue marlin, yellowfin tuna, and associated species. Time-depth recorders (TDR) were used to keep track of the longline fishing gear while hook timers were used to measure the time at which fish were caught. Since the depth of longline gear changes during deployment, soaking and retrieval, hook timers combined with TDRs are necessary to establish capture depth. Changes in fishing depth relative to habitat depth can affect CPUE in ways that may obscure the true status of the resource. This research was an extension of an earlier study published in Fishery Bulletin (Boggs 1992).

A total of 25 sets was made, with fishing effort totalling about 13,000 hooks. The catch totalled 384 fish of 21 species, mostly non-target species such as lancetfish, mahimahi and sharks. Blue marlin were the most common billfish. Due to the lateness of the season, yellowfin tuna were less numerous than bigeye or albacore.

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[2] Compiled from NMFS (1993), Director's Report to the 44th Tuna Conference: On tuna and tuna-related activities at the Southwest Fisheries Science Center for the period May 1, 1992, to April 30, 1993. Southwest Fisheries Science Center, La Jolla, Administrative Report LJ-93-05, 41p.

Hook timers indicated that fish survived many hours after being captured, with tuna tending to survive longer than billfish. Blue marlin tended to be less hardy (had shorter survival times) than striped marlin, based on striped marlin data from previous cruises. Most tuna, billfish and sharks were alive when retrieved and were released. Fifty-one fish were also tagged and released, including 6 yellowfin tuna, 8 bigeye tuna, and 22 blue marlin. Experiments with tethering longline-caught tuna were also conducted. The objective was to provide live fish for tagging with ultrasonic transmitters. Five of seven tuna tethered survived, but no fish were tracked due to problems with tracking equipment.

Oceanographic measurements were also taken and indicated that a subsurface feature influenced CPUE for bigeye tuna. The feature was a transition in the depth of the thermocline and oxycline found between latitudes 16.5-18° N. Bigeye tuna were abundant along the north edge of the feature. (Christofer Boggs)

Interactions of the North Pacific Albacore and High-seas Driftnet Fisheries

Scientists from the Honolulu and La Jolla Laboratories examined net-scarred and normal albacore caught by domestic trollers in the North Pacific, to determine whether albacore that are entangled in the nets and subsequently drop out are adversely affected or experience higher mortality. If so, the North Pacific albacore stock could be impacted more seriously by high-seas gillnets than landings would indicate. Length-weight data, otoliths, blood and muscle samples were collected by observers aboard domestic trollers, in cooperation with the Western Fishboat Owners Association. The results did not show any significant differences between normal and net-scarred fish caught by the troll fleet. This indicates that fish escaping from driftnets, and surviving long enough to be recaptured by trollers, probably do not suffer increased mortality. The percentage of albacore that drop out and die or do not resume feeding, however, is not known. (Richard Brill and David Holts)

Note: A United Nations Resolution prohibited high-seas drift gillnet fishing in January 1992. If all nations abide by the resolution, interactions of this nature will decline.

North Pacific High-Seas Driftnet Statistics Analyzed

Driftnet fisheries have been the dominant fisheries in the North Pacific Transition Zone (NPTZ), where three species groups have been targeted, neon flying squid, tunas, and billfish. Vessels from Japan, Taiwan, and the Republic of Korea target neon flying squid, while other vessels from Japan and Taiwan target tunas and billfish. Data from a cooperative scientific observer program are being analyzed at the Honolulu Laboratory to assess impacts of the high-seas driftnet fisheries on cephalopod and non-salmonid fish resources in the North Pacific, and to obtain bycatch estimates for the 1990-91 fishing seasons.

An estimate of total bycatch (non-target catches) requires assessment of "dropouts" during net retrieval, that is, an animal that emerges from the water entangled in the net, but falls out before it reaches the deck. Results of this assessment are used in conjunction with data from bycatch on deck to develop a model to estimate total bycatch. Total bycatch levels are calculated using a ratio estimator, with fleet effort being provided by the different countries. Bycatch estimates are stratified by target species and country. In all analyses, a unit of fishing effort is standardized and equal to 50 meters of driftnet. Bootstrap procedures (N = 1000) are being used to develop 95% total bycatch confidence intervals.

Species-specific metrics of exploited biomass are estimated by apportioning total bycatch to length categories based on length-frequency data collected by observers and converting length to weight using derived length-weight relationships. These data will be used in the development of ecosystem and fishery interaction models.

A model is being developed to identify factors contributing to the observed bycatch. Environmental data collected by observers and physical data pertaining to the NPTZ are being analyzed in an effort to elucidate relationships and foster hypotheses of biological-physical interactions. (Gerald DiNardo)

Tuna and Billfish Studies Under Way as Part of Driftnet Program

As part of the North Pacific driftnet monitoring program and assessment research at the Honolulu Laboratory, several ancillary studies related to tuna and billfish resources are under way. Studies estimating the age and growth of North Pacific albacore (*Thunnus alalunga*) are being conducted by scientists from the Honolulu and La Jolla Laboratories. (Keith Bigelow and Robert Nishimoto)

Diet studies of the swordfish (*Xiphias gladius*) are being carried out to evaluate the ecological relationships of swordfish and seasonally migrating transition zone species (particularly flying squid, *Ommastrephes bartramii*). Preliminary results support the notion that swordfish feed on concentrations of mature, spawning flying squid. (Mike Seki)

Mike Seki is also preparing profiles of tunas and billfishes taken in high-seas driftnet fisheries as part of a comprehensive faunal atlas of marine resources in the North Pacific Transition Zone, where the driftnet fisheries operated. The atlas will cover other fishes and cephalopods as well as marine mammals, seabirds, and turtles. Profiles will summarize life history and ecological information available for the pertinent species through an extensive review of existing literature and from information collected by observers aboard commercial foreign squid and large-mesh fishing vessels.

Information on disposition and shipboard processing of tuna and billfish landed from 1990 to 1991 by foreign high-seas driftnet fisheries are being compiled and analyzed. In addition, the occurrence of elliptical scars, located antero-laterally of the anal fin, found on 100 percent of longline-caught albacore landed in Hawaii from 1991 to 1993 is being investigated. An ectoparasitic copepod, *Caligus* spp., has been identified as the most probable source of the scars. This copepod has been found on albacore landed with trolling gear as well as longline gear. (Donald Hawn)

Tuna and Billfish Physiology and Behavior Research

Honolulu Laboratory scientists have found that tuna have rapid and extensive control of the efficacy of their vascular counter-current heat exchangers. This means tunas are not forced out of formerly suitable habitats as they grow because of potential overheating. Furthermore, tunas can exploit food resources below the thermocline because rates of heat loss can be minimized when diving into colder waters and rates of heat gain can be maximized when returning to the upper mixed layer. Work on low ambient oxygen tolerance shows that tunas have high oxygen demands even at very slow speeds because of their large thin gills, which permit high rates of oxygen and carbon dioxide exchange, but also allow high rates of passive salt and water movements. Therefore, there is a high energy cost for maintaining salt and water balance, and thus a high metabolic rate even at slow swimming speeds. Recent laboratory research also indicates that the ability of the tuna's cardiorespiratory system to deliver oxygen at extraordinarily high rates most likely evolved to permit rapid recovery from strenuous exercise, rather than to permit high sustained cruising speeds. (Richard Brill)

Richard Brill of the Honolulu Laboratory and David Jones of the University of British Columbia measured the viscosity of tuna blood at various temperatures and shear rates. Viscosity increased with increasing hematocrit, but also increased non-linearly with decreasing shear rate until a shear rate of 90 s^{-1} was reached. Because of the relatively flat hematocrit-viscosity curves, predicted optimal hematocrit curves were nearly flat above a hematocrit of approximately 30 percent.

Scientists from the Honolulu Laboratory, La Jolla Laboratory, Scripps Institution of Oceanography, and Woods Hole Oceanographic Institute recently studied the vertical and horizontal movements of striped marlin, *Tetrapterus audax*, while simultaneously gathering water temperature and oceanic current data near the Hawaiian Islands. Fish movements were tracked using ultrasonic depth-sensitive transmitters and depth temperature profiles and oceanic current patterns were also measured. The NOAA vessels *Townsend Cromwell* and *Kaahele'ale* were used in tracking. The movements of striped marlin were strongly influenced by currents, some individuals spent most of the time drifting. Like Indo-Pacific blue marlin (*Makaira mazara*), striped marlin spent most of their time in the upper mixed layer

above 90 meters. By comparing with data from other areas, it was found that striped marlin do not have an absolute temperature preference, but rather spend most of their time in the warmest water available. The data also show that the maximum depth to which striped marlin descend is limited to water temperatures 8° C colder than the upper mixed layer. (Richard Brill)

Scientists are using a swim tunnel to study tuna in captivity at the Kewalo Research Facility of the Honolulu Laboratory. The 1.2 meter long swim tunnel, designed and built by Jeff Graham of Scripps Institute of Oceanography, permits observing tuna swimming behavior at various speeds for long periods of time. It functions as an aquatic "treadmill," permitting scientists to make physiological measurements of tunas under varying conditions of swim speed, water temperature, and oxygen level. Current studies by Graham and some graduate students are examining how the skin, muscles, and heart of yellowfin tuna affect swimming performance. (Richard Brill)

Tag Data Shows Effects of FADs on Tuna Movement

A La Jolla Laboratory scientist participated in a collaborative effort with the South Pacific Commission's (SPC) Tuna and Billfish Assessment Programme to develop a skipjack tuna population dynamics and movement model for the Solomon Islands. The model uses SPC tag and recovery data. The model would be used in addressing concerns about fishery development and interactions in the region, in particular, to help answer questions about the effectiveness of deploying more floating aggregation devices in the Solomon Islands. The model incorporates natural mortality, fishing mortality by purse-seine and pole-and-line fleets, and movement of skipjack around FADs and islands. The initial results show the effect of FADs using ordinary tag release and recovery data. (Pierre Kleiber)

Blue Marlin Tagged and Released During Tournaments

A record number of blue marlin were tagged and released during the Pro-Am and Hawaiian International Billfish tournaments conducted off Kailua-Kona, Hawaii, in early August 1992. Seventy-six fishing teams from throughout the world tagged and released 128 billfish using NMFS tags. One hundred twenty two blue marlin, five striped marlin, and two shortbill spearfish were tagged. Additional blue marlin were tagged with Australian or Billfish Foundation tags, for a total of 135 billfish tagged. An estimated total of 9.7 tons of billfish were tagged. A tagged blue marlin originally tagged by a team from Tahiti was recovered three days later off Keauhou Bay, a few miles south of Kailua-Kona. (Norman Bartoo)

Hawaii Longliners and Trollers Tag and Release Billfish

Since 1991, Hawaii commercial longline fishermen have tagged and released 119 swordfish, 7 other billfish, and 13 bigeye tuna, as part of the Cooperative Marine

Gamefish Tagging Program (CMGTP) provided by the La Jolla Laboratory. The Honolulu Laboratory has also tagged and released longline-caught billfish on research cruises since 1989. A total of 102 fish have been tagged with special tags, offering cash awards for return of the fish heads for recovery of otoliths marked with oxytetracycline. The number of longline-caught fish tagged and released totals 339, including 142 swordfish, 41 striped marlin, 27 blue marlin, 16 spearfish, 56 bigeye tuna, 16 yellowfin tuna, and six moonfish (opah).

Of the 339 fish tagged, two bigeye tuna and one striped marlin have been recovered. Some tags were recovered at the United Fishing Agency auction, indicating that low tag recovery rates may be due to under-reporting of tag recaptures. Hawaii longline fishermen accounted for 50% of the striped marlin recaptures originally tagged by troll fishermen. Eight striped marlin and one blue marlin were recovered by the longliners in 1990-92. Two of the striped marlin recovered were tagged off southern California. One skipjack tuna was recovered in the Solomon Sea, 2,000 miles from its release site.

Hawaii trollers accounted for 33% of the striped marlin and 81% of the blue marlin tagged in the Pacific by the CMGTP in 1991. Hawaii trollers and longliners have accounted for 10 of the 15 billfish recaptures in the Pacific. Hawaii trollers have tagged over 1,000 blue marlin since 1980, including about 400 in 1991-92. (Christofer Boggs)

Modeling of Longline Permit Management Alternatives

In helping to develop Amendment 7 (limited entry program) to the Pelagics FMP, Samuel G. Pooley and Robert A. Skillman developed a spreadsheet model of the Hawaii longline fishery to simulate probable changes in the fishery due to combinations of management elements. The model simulates changes in catches by species, vessel size classes, and fishing areas due to various combinations of limited entry permit conditions, transferability, upgradability, and inside/outside EEZ permits. The model is being used to assess management alternatives that could be incorporated into the proposed amendment to implement a limited-entry longline fishery when the current moratorium on new longline participants expires in April 1994. Christofer Boggs, Svein Fougner, Alvin Katekaru, and others at the Honolulu Laboratory and Pacific Area Office have also assisted the Council staff in drafting parts of the amendment. (Samuel Pooley)

In addition to NMFS research, a new program of research on pelagic fisheries began in 1992. Coordinated by the Joint Institute for Marine and Atmospheric Research, a joint research institute of the University of Hawaii and NOAA, the Pacific Pelagic Fisheries Research Program (PPFRP) is an inter-disciplinary research program directed toward understanding the dynamics of pelagic fisheries in the Pacific. The primary goal of the research is to provide information that (a) will aid

the Council in resolving fishery management problems in the region, and (b) can be used to develop rational long-term management policies. The PPFRP will conduct research on population dynamics and biology of exploited species, on oceanographic processes that affect population dynamics, and on the social and economic forces that influence fishing activities.

The following projects are currently approved under the program:

- Local pelagic catch and effort data analysis and integrated modeling to quantify the effects of local fisheries on fish availability.
- Design of tag-recapture experiments for estimating yellowfin tuna stock dynamics, movements, and fishery interactions.
- Analysis of Pacific blue marlin and swordfish population structure using mitochondrial DNA technologies.
- Automated monitoring of yellowfin tuna at Hawaiian FADs and relationship to water mass dynamics based on satellite imagery.
- Reproductive biology of yellowfin tuna, *Thunnus albacares*, in Hawaiian waters and the western tropical Pacific Ocean.
- Physical characteristics of the environment influencing pelagic fishes.
- Hawaii pelagic fishing vessel economics.
- Social aspects of the Hawaiian pelagic troll fishery.
- The structure and dynamics of the US market for fresh Pacific tuna and marlin.
- Contributions of tuna fishing and transshipment operations to local economies.
- Development of assessment model for western Pacific yellowfin tuna.

Plan Administration and Enforcement

Administrative Activities (NMFS Southwest Region)

No administrative actions relating to foreign fishing in the western Pacific EEZ were required because no foreign fishing permits were requested for any vessels with which the USA has a Governing International Fishing Agreement.

The Southwest Region prepared for approval by the Secretary of Commerce and publication in the *Federal Register* two final regulatory actions for Pelagic FMP Amendment 5, governing longline area closures around the main Hawaiian Islands and Guam, a final rule for Amendment 6 making consistent the 1990 amendments to the Magnuson Act which established US jurisdiction over fisheries for tuna within the EEZ, and a control date for the tuna handline fishery in the EEZ around Hawaii:

- 4 March 1992 (57 FR 7661) -- Final Rule for FMP Amendment 5 -- prohibits longline fishing within 75 nautical miles (nm) of the islands of Oahu, Kauai, Niihau, and Kaula, and within 50 nm of the islands of Hawaii, Maui, Kahoolawe, Lanai, and Molokai. A longline area closure of approximately 50 nm also was established around Guam and its offshore banks.

- 14 August (57 FR 36637) as revised on 15 September 1992 (57 FR 42551) -- Notice of control date for entry into the handline fishery in certain areas of the EEZ around Hawaii.

- 6 October 1992 (57 FR 45989) -- Final Rule for seasonal modification of the longline fishing area closures of certain areas off the windward sides of the main Hawaiian Islands.

- 27 October 1992 (57 FR 48564) -- Final Rule for FMP Amendment 6 -- Tunas and related species were included in the fishery management unit of the FMP; waters in the EEZ that were closed to domestic longline vessels were also closed to foreign vessels fishing for pelagic species; and certain general foreign fishing regulations, including reporting requirements which currently apply to longline vessels, were also applied to foreign baitboat and purse seine vessels.

In 1992, the Pacific Area Office (PAO) issued or renewed 168 general longline fishing permits allowing domestic longliners to fish within the EEZ of the western Pacific region. Most of these vessels (166) also held Hawaii longline limited entry permits.

As approved by the Regional Director, the PAO transferred 15 longline limited entry permits to new vessel owners under the one-time transfer provision of the FMP's

moratorium on new Hawaii longliners. Three permits were transferred to replacement vessels. The number of permits transferred (18) to new permit holders and replacement vessels during 1992 was almost double the number of transfers that occurred in 1991, the first year of the moratorium.

In 1992, the PAO received 893 notifications that vessels were arriving to port, as required from all longline operators following each trip, which were coordinated with the NMFS Honolulu Laboratory and NMFS Enforcement as part of logsheet catch and effort data collection program.

Enforcement Activities

Details of enforcement efforts are provided periodically to the Council by the USCG and the NMFS Office of Enforcement. These reports are on file at the Council. The following is a brief summary of enforcement activity in 1992.

From 1 January 1992 to 31 March 1993, the USCG conducted a total of 1,058 hours of fisheries patrols with C-130 aircraft in the Western Pacific region and 394 hours with HH-65 helicopters around Hawaii. They made a total of 555 sightings of fishing vessels in the region EEZ, most of which were domestic vessels. Of the 62 or more fishing vessels boarded, no violations were found except for one Taiwanese longliner caught fishing in the American Samoa EEZ -- the catch of the *F/V Huey Chuen No. 3* was seized and forfeited.

During fiscal year 1992, the USCG expended 144 high-endurance cutter days and 771 aircraft hours in fisheries patrols in the Western Pacific region during fiscal year 1992 (October 1991 - September 1992), representing substantial increases in effort (311% and 118%, respectively) from FY-91. The aircraft hours include short-range patrols by HH-65 helicopters, mainly in the Main Hawaiian Islands longline closure zone, and long-range patrols of the EEZ by C-130 aircraft.

The NMFS Office of Enforcement noted that, in general, relatively few violations occurred in the Western Pacific pelagic fisheries. From March 1992 to April 1993, NMFS agents accompanied 35 USCG C-130 patrols, 39 USCG HH-65 helicopter patrols, 12 charter flights out of Guam, and one USCG cutter patrol. They initiated five foreign fishing cases and 11 domestic cases, most of which were logbook or permit violations. Five domestic longline vessels were cited, and one of them, the *F/V East Ocean*, was seized for fishing in the closed area and for non-payment of previous penalties, making it the first domestic vessel seized under this FMP.

Protected Species Conservation

During the year, the Protected Species Program of the PAO placed an observer aboard a longline vessel that fished around the Northwestern Hawaiian Islands (on a volunteer basis). A summary of the observer trip will be included in a future

report containing information pooled from at least two other observer trips from the area.

A review of 1991 longline logbook data and the annual report of the 1991 longline fishery indicated a total incidental take of listed sea turtles in excess of the level authorized in the May 1991 Biological Opinion/Incidental Take Statement for the Pelagics FMP. Internal consultation within NMFS was initiated in 1992 to consider the need for a new Biological Opinion and Incidental Take Statement to address the greater incidental take of sea turtles by the Hawaii-based longline fishery resulting from a larger fishing area and greater fishing effort than described in the original incidental take statement.

Habitat Issues

There is no information to suggest that the habitat of Pacific pelagic management unit species was subjected to major alterations in 1992. The continuing introduction of low-level pollution from diverse sources, however, combined with occasional pulses of higher levels, is an ongoing problem. The impacts of this pollution on management unit species, particularly the egg and larval stages, is unknown. Pollution sources include runoff from high islands, sewage from island outfalls and ships, oil from ship bilges and accidental spills, and marine debris originating from land or ships in the region, or drifting in from other areas.

Two powerful hurricanes hit the Pacific islands during the year. In August 1992, Hurricane Omar devastated Guam and in September 1992, Hurricane Iniki similarly impacted the island of Kauai. Many fishing vessels were sunk in harbors and at sea. All these contributed to the low-level pollution impacts to the habitat of pelagic management unit species during 1992.

The Council and NMFS continue to receive and review periodic reports of the ocean dumping of cannery waste from the two tuna canneries in Pago Pago, American Samoa. The dumping is authorized under special permits from the US Environmental Protection Agency, and no significant impacts have been noted.

Appendix 1

Territory of American Samoa

Introduction

The pelagic fishery of American Samoa is monitored by the Department of Marine and Wildlife Resources (DMWR), through a program established in conjunction with the Western Pacific Fishery Information Network. Prior to 1985, only commercial landings were monitored. From October 1985 to the present, data were collected through a creel survey and, therefore, accounted for subsistence and recreational fishing in addition to commercial landings. The staff of the DMWR prepared this report using information that was derived from a statistically-designed survey of all pelagic fishing activities.

Each year several fishing tournaments are held on Tutuila, the main island. Tournament catches are usually sampled completely, with individual weights recorded for all fish species (except skipjack tuna) recorded. Normal creel surveys are never scheduled on tournament days since they are not representative of a "typical" fishing day (e.g., more than the usual number of boats will fish in tournaments, and fishing techniques shift from those that target skipjack, to those that target billfish and mahimahi).

Appendix 1.A (Supplemental) describes the fisheries data collected from sport fishing tournaments that are held on Tutuila each year. These tournaments are sampled by DMWR technicians separately from the normal offshore fishery. Tournament data include the areas fished, type and number of gear units, number of fishermen per boat, hours fished, names of fishermen, and fish weight.

Appendix 1.B (Supplemental) describes a survey of American Samoa's local fishing fleet, which was conducted to determine the cause of the general decline in vessel activity since the mid-1980s. The survey did not include large, distant-water purse seiners and longliners which make landings to the two canneries in Pago Pago Harbor, nor are the boats participating in sport fishing tournaments.

Summary

The pelagic fishery in American Samoa, which began in the early 1970s, continues to operate on a small scale. In 1992, 27 boats made an estimated 649 trips where a pelagic fish species was landed. The majority of the boats operated on a part-time basis, and most trips were one day in duration.

In general, American Samoa's pelagic fishery appears to be driven more by economics and the effects of hurricanes than by species abundance and

availability. In the early 1980s, the fishery enjoyed rising prices and government assistance in the form of low interest loans for boat purchases and an active program to develop gear types and techniques applicable to American Samoa.

Several devastating hurricanes have struck the territory recently: Tusi in January 1987, Ofa in February 1990, and Val in December 1991. The effects of these hurricanes can be seen in the fishing effort data; notable decreases in effort are seen in 1987 and 1990. Corresponding drops in catch and revenue are also evident. Although Hurricane Val was one of the most devastating hurricanes in recent memory, its effects are not evident in the catch data for 1992. Only three fewer boats fished pelagic species in 1992 than 1991, and we observed a slight decrease in the number of fishing trips. However, there was a modest increase in both catch rates and total catches of pelagic species.

Prices paid for tunas have increased steadily in recent years, reaching a record high in 1991. Prices for other PPMUS species have fluctuated, but have generally not kept pace with inflation. Although catch rates, total catch, and prices have increased in recent years, the revenue per PPMUS trip has only held steady, due probably to fishermen making shorter trips. From 1983 to 1987, trips averaged 8.7 hours, however from 1988 to 1992 trips averaged only 6.4 hours.

The fishery faces competition from two main sources. First is continuing competition from a supply of frozen fish, either purchased or bartered from foreign longline vessels moored in Pago Pago Harbor. In some cases, vessel skippers act as middlemen in the transactions. Poor documentation of these transactions makes it difficult to assess the influence of these fish on the market for fresh fish that are supplied by local fishermen. The local fishery also competes with fresh fish that are flown in from Western Samoa and Tonga.

Storekeepers in American Samoa report that the importers can often provide a more consistent supply and better prices than can be obtained from the local fishing fleet. A market survey beginning in 1990 shows that about 50% of all fish species are imported from Tonga and Western Samoa. The market share of imported pelagic species has declined from 66% in 1990 to 20% in 1991 and only 3% in 1992. The market share of imported bottom fish species held steady around 90% for these three years, and imports of reef fish have increased dramatically from 23% in 1990 to 78% in 1992. This data is presented in more detail in the "Inshore Fishery of American Samoa, 1992" report.

Table 1. American Samoa 1992 estimated total landings of pelagic species.

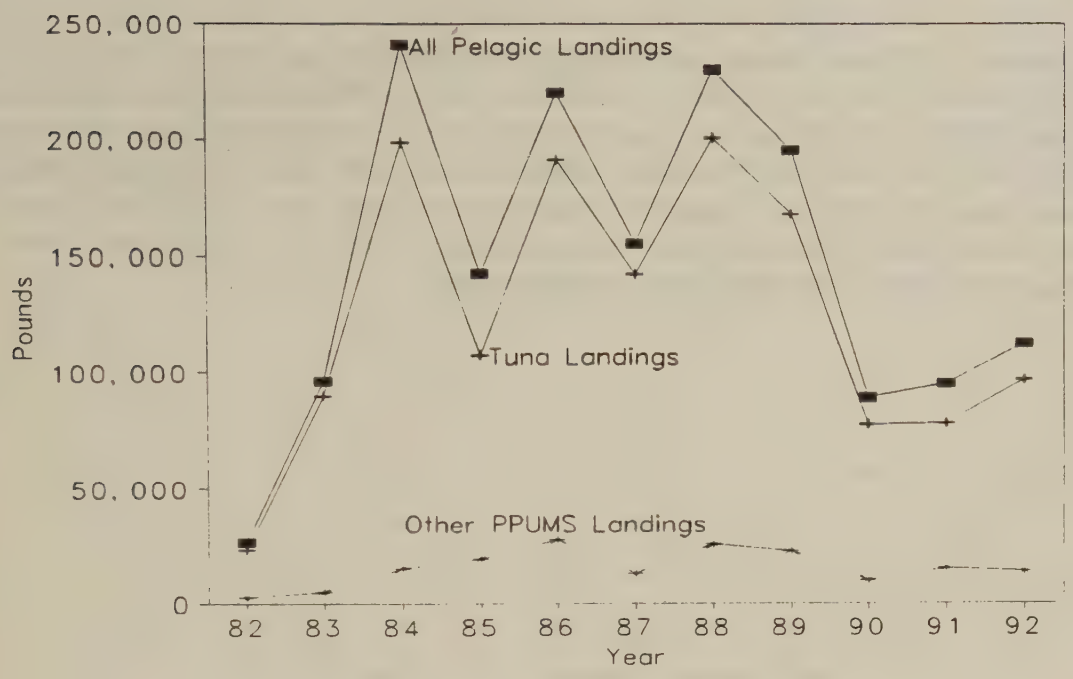
Species	Pounds
Skipjack Tuna	71930
Albacore	0
Yellowfin Tuna	24684
Kawakawa	183
Subtotal Tunas[1]	**96797**
Sharks	1348
Mahimahi	1987
Blue Marlin	4628
Wahoo	3381
Dogtooth Tuna	2093
Subtotal other PPMUS	**13437**
Rainbow Runner	1197
Barracudas	1000
Subtotal Misc	**2197**
Total Pelagics	**112431**

[1] Prior to 1992, tunas and related species were not included as Pelagic Management Unit Species, (PMUS). In 1992, PMUS was redefined as PPMUS (Pacific Pelagic Management Unit Species) and included tunas.

Table 2. American Samoa 1992 estimated commercial landings, value and average price of pelagic species.

Species	Pounds	Value ($)	$/lb
Skipjack Tuna	70358	56030.23	0.80
Albacore	0	0.00	0.00
Yellowfin Tuna	24510	54460.63	2.22
Kawakawa	183	157.17	0.86
Subtotal Tunas	**95051**	**110648.03**	**1.16**
Sharks	399	678.79	1.70
Mahimahi	1860	4377.39	2.35
Blue Marlin	4598	8622.13	1.88
Wahoo	3194	5323.25	1.67
Dogtooth Tuna	1758	3511.63	2.00
Subtotal other PPMUS	**11809**	**22513.19**	**1.91**
Rainbow Runner	1106	2100.59	1.90
Barracudas	974	1754.09	1.80
Subtotal Misc	**2080**	**3854.68**	**1.85**
Total Pelagics	**108940**	**137015.90**	**1.26**

Figure 1. American Samoa annual estimated total landings -- all pelagic and PPMUS.

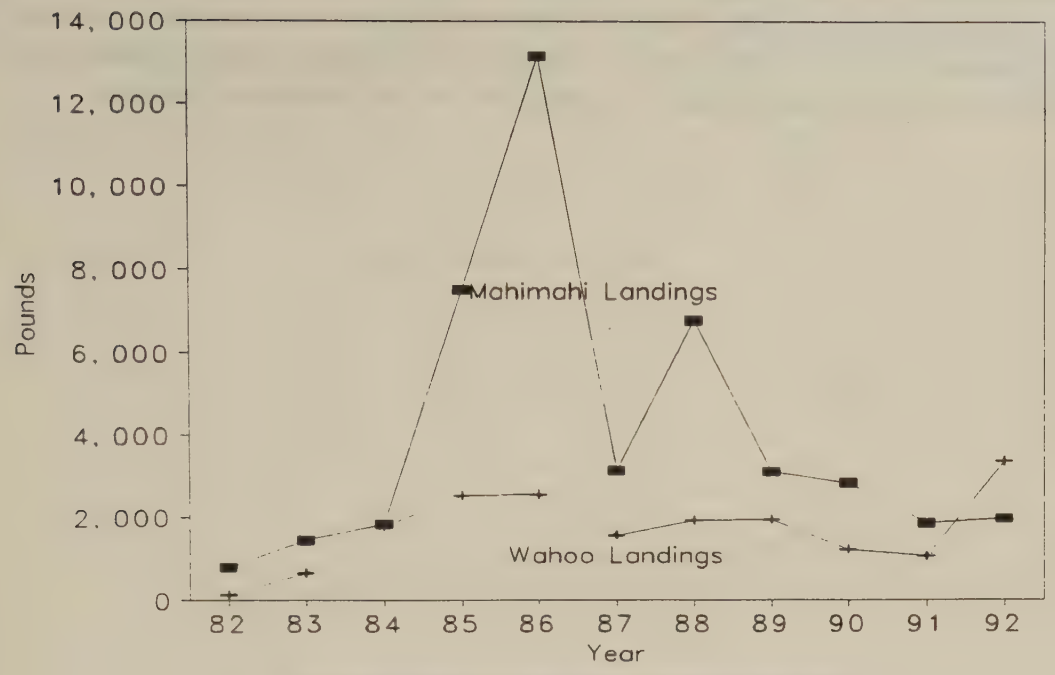


Year	Pounds Landed		
	All Pelagics	Tuna	Other PPMUS
1982	26396	23042	2106
1983	96318	90057	4806
1984	241099	198961	15121
1985	142570	107453	19262
1986	220571	191596	27416
1987	155324	142319	12613
1988	230516	200785	25439
1989	195728	168325	22705
1990	89322	77626	9804
1991	95020	78225	14942
1992	112431	96797	13437

Calculation: Estimates for all pelagic species and PPMUS by all fishing methods are summed. These values include both commercial and recreational/subsistence components of the fishery.

Interpretation: Although landings have been highly variable, 1990 - 1992 landing levels are notably low, due mainly to reduced fishing effort after Hurricane Ofa hit in February 1990. Tunas are the main component of the total pelagic landings, comprising approximately 90% of the catch in any given year. Trolling is the gear type responsible for the vast majority of pelagic species catch in all years, but some large landings of primarily tuna species were made by a single domestic longline vessel which operated from 1983 to 1985.

Figure 2. American Samoa annual estimated total landings -- mahimahi and wahoo.

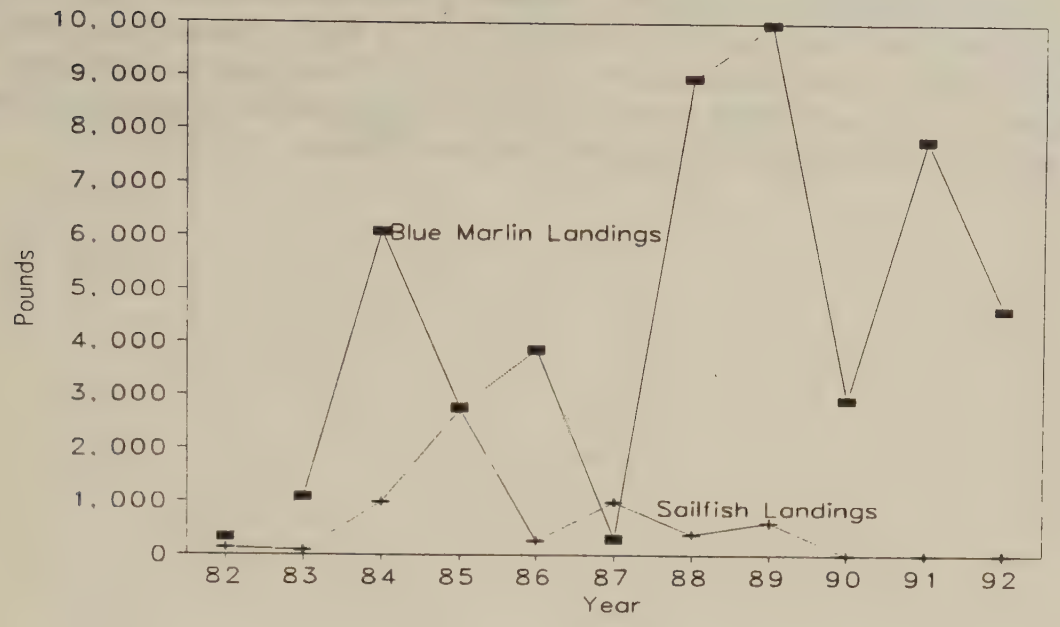


Year	Pounds Landed	
	Mahimahi	Wahoo
1982	777	114
1983	1443	632
1984	1844	1777
1985	7528	2535
1986	13160	2564
1987	3136	1563
1988	6791	1929
1989	3120	1959
1990	2833	1225
1991	1859	1048
1992	1987	3381

Calculation: The estimated total landings for mahimahi and wahoo are summed for all fishing methods.

Interpretation: Wahoo landings continue to be relatively stable, and contribute only small amounts to the total catch. Mahimahi landings are highly variable through time; the reasons for this variability are unknown, but this variability is evidenced in each of the region's island groups. Wahoo landings were similarly variable, and reached a record high in 1992. From 1984-88, American Samoa fishermen exported mahimahi to Hawaii, but this market has not operated recently.

Figure 3. American Samoa annual estimated total landings -- blue marlin and sailfish.

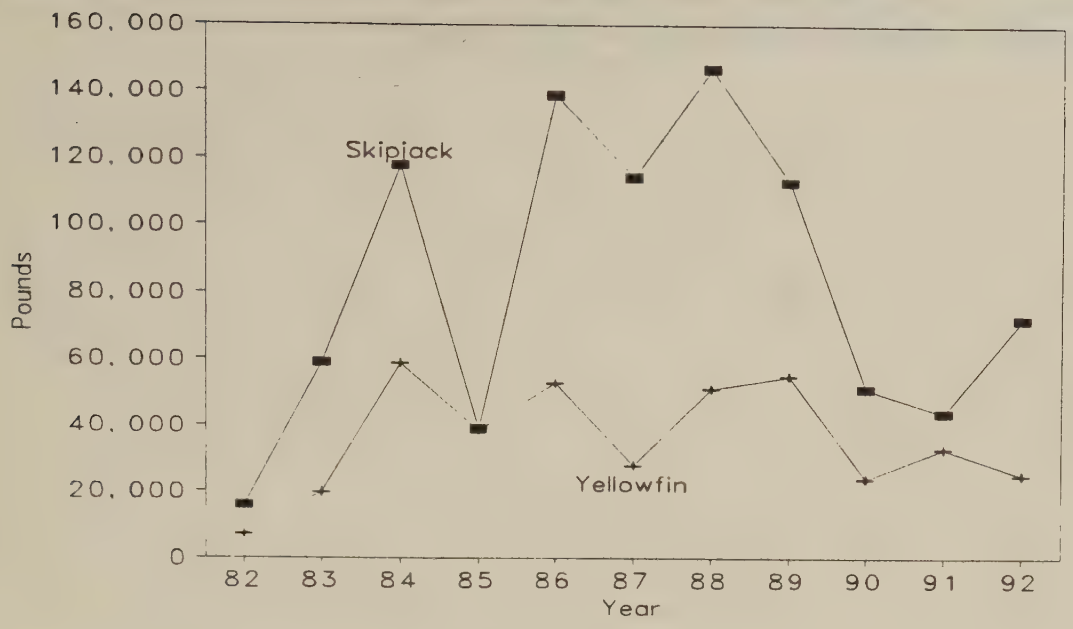


Year	Pounds Landed	
	Blue Marlin	Sailfish
1982	315	127
1983	1083	74
1984	6097	989
1985	2778	2744
1986	3871	259
1987	297	986
1988	8959	367
1989	9969	597
1990	2922	0
1991	7804	0
1992	4628	0

Calculation: The estimated total landings of blue marlin and sailfish are summed for all fishing methods.

Interpretation: Landings of both species have been historically variable. Local commercial fishermen rarely target billfishes because of the lower CPUE and market price, relative to skipjack tuna. An exception would be on tournament days, where fishing strategy is vastly different. Tournament data are not included in these figures (see Introduction). Prices for both of these species have remained relatively low and stable, ranging from $0.72 to $1.01 per pound. The large fluctuations in catch and CPUE (see Fig. 10) for these species is probably related to species abundance or other unknown biological factors.

Figure 4. American Samoa annual estimated total landings -- skipjack and yellowfin tuna.

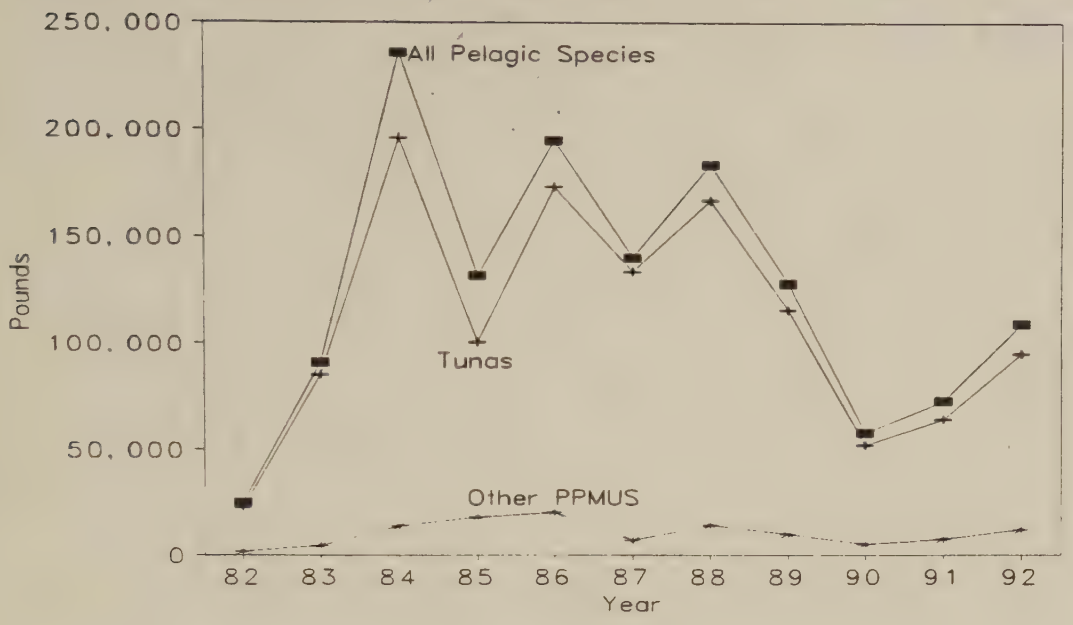


Year	Pounds Landed	
	Skipjack Tuna	Yellowfin Tuna
1982	15877	7038
1983	58997	19789
1984	117693	58704
1985	38939	38343
1986	138826	52662
1987	114406	27767
1988	146874	51022
1989	112987	54666
1990	50877	23635
1991	43662	32643
1992	71930	24684

Calculation: The estimated total landings of skipjack and yellowfin tuna are summed for all fishing methods.

Interpretation: Skipjack and yellowfin tuna are the two main contributors to total pelagic landings (see Table 1). The decreased landings seen from 1990 to 1992 are a result of decreased effort as CPUE for Yellowfin has held relatively stable, and the CPUE for skipjack increased in 1992, (Figure 11).

Figure 5. American Samoa annual estimated commercial landings -- all pelagic species and PPMUS.

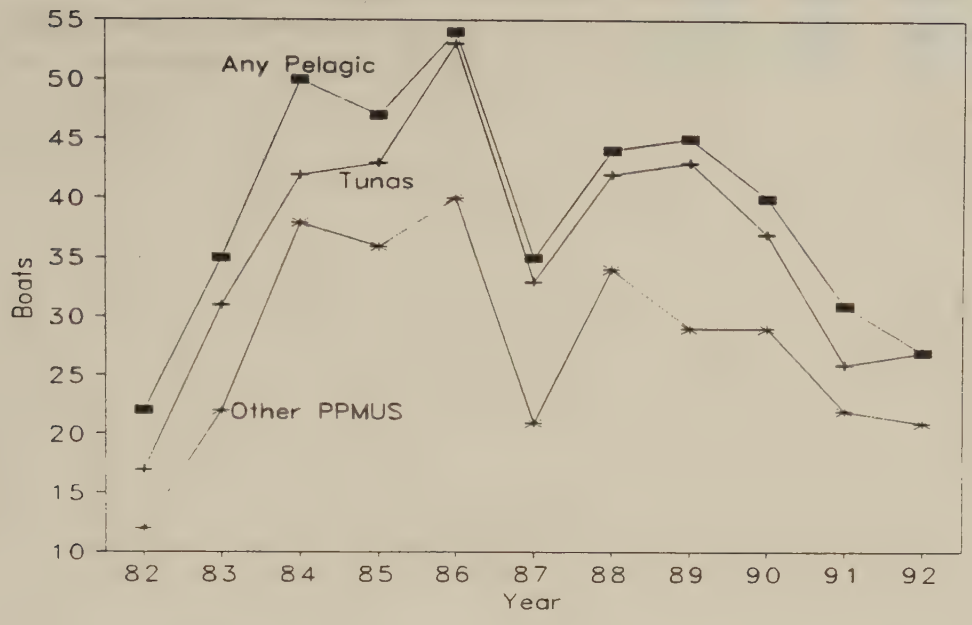


Year	Pounds Landed		
	All Pelagics	Tunas	Other PPMUS
1982	24820	22065	1515
1983	90744	85069	4441
1984	236216	196100	13458
1985	131623	100373	17448
1986	194717	173374	20278
1987	140031	133594	6236
1988	183379	166915	14062
1989	128096	115485	9731
1990	57907	51995	4858
1991	72664	64037	7318
1992	108940	95051	11809

Calculation: The total estimated pounds of all the pelagic species, tunas only, and other PPMUS only are summed for all methods of fishing, only for fish that were sold.

Interpretation: The decrease in commercial pelagic landings in 1990 and 1991 is due mainly to decreases in tuna landings as discussed in Figure 4. Landings in 1992 increased in spite of a slight drop in effort, primarily due to an increase in skipjack CPUE.

Figure 6. Number of American Samoa boats landing any pelagic species, tunas and other PPMUS.



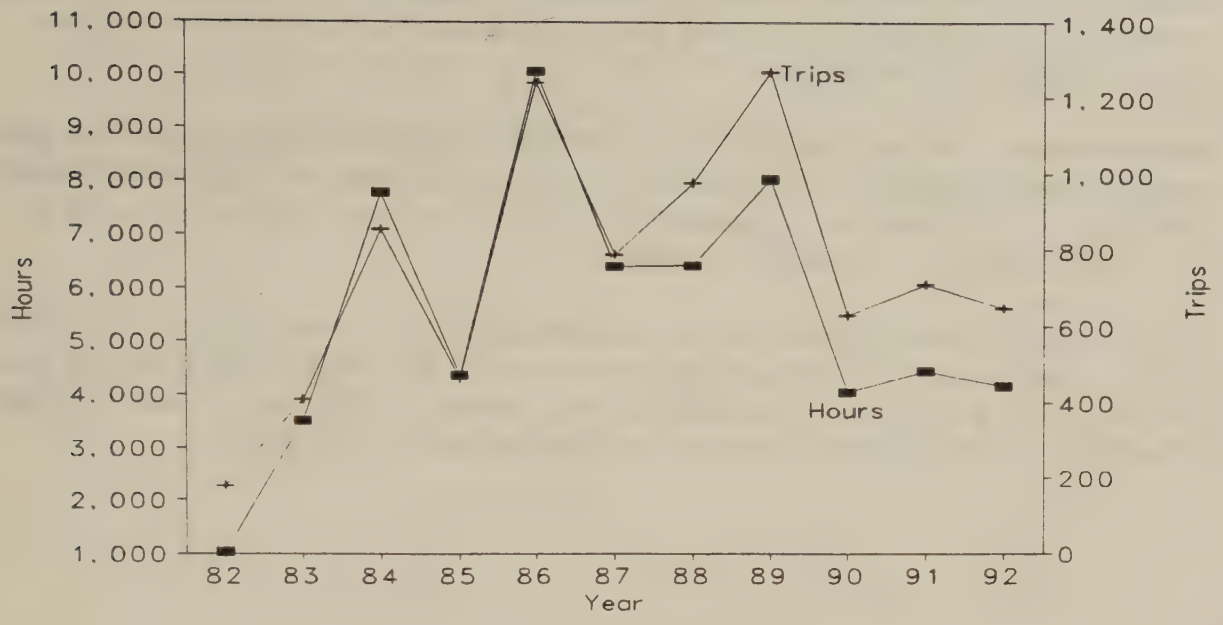
Year	Number of Boats landing:		
	Any Pelagic	Tunas	Other PPMUS
1982	22	17	12
1983	35	31	22
1984	50	42	38
1985	47	43	36
1986	54	53	40
1987	35	33	21
1988	44	42	34
1989	45	43	29
1990	40	37	29
1991	31	26	22
1992	27	27	21

Calculation: The sampling program is extensive enough, and the number of boats is small enough, to use the raw database counts of the number of unique vessels in a given year. When the data are collected, the vessel is always identified. Each

of the boats counted in the above table made at least one recorded landing of at least one pelagic species during a given year.

Interpretation: After peaking in 1986, the fishery has declined as boats fell into disrepair, were damaged by hurricanes, or the fishermen left the fishery for other reasons. *An analysis American Samoa fishing vessel participation is presented in Appendix 1.A.*

Figure 7. American Samoa annual estimated effective fishing effort for pelagic species (trolling method only).



Year	Estimated Trolling Effort	
	Hours	Trips
1982	1019	177
1983	3513	406
1984	7785	853
1985	4375	462
1986	10263	1262
1987	6218	764
1988	6372	969
1989	8153	1271
1990	4120	634
1991	4656	739
1992	4212	657

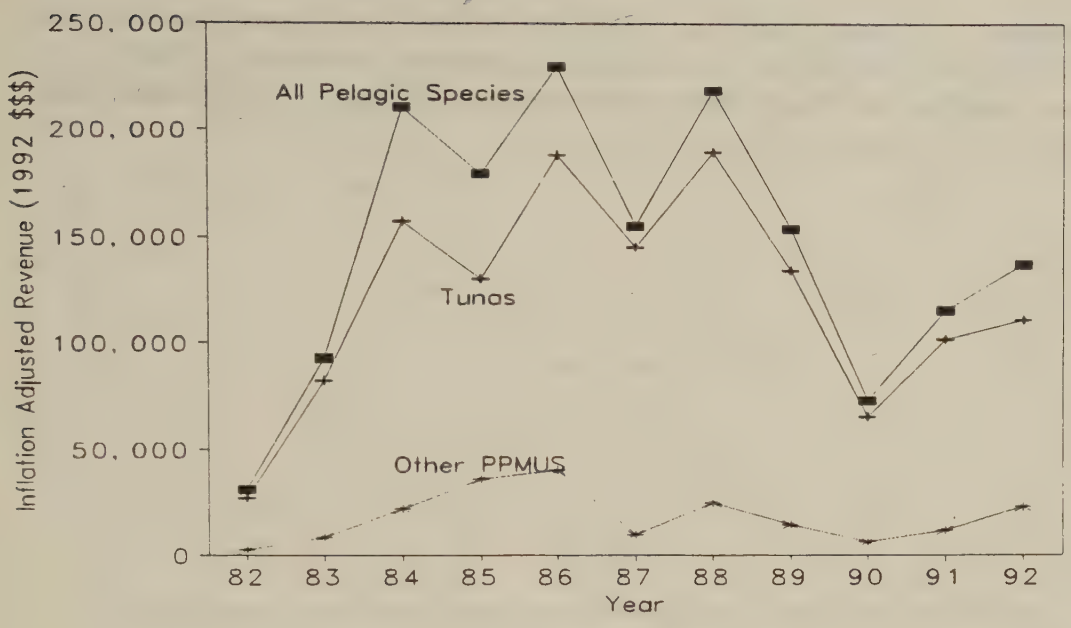
Calculation: The estimated total annual landings of all pelagic species is used as a base for calculating the estimated number of trips and hours spent fishing for pelagic species by vessels using trolling methods only. The estimated total longliner landings are subtracted from the total pelagic landings, and the resultant

number is divided by the average catch per hour (CPUE) for the trolling method to give an estimate of the hours trolled. The CPUE is calculated using only those trips which only trolled, and for which the number of hours was recorded. The number of trips is calculated by dividing the estimated annual number of hours by the average length of a trolling trip.

Interpretation: The amount of effort expended to catch pelagic species has been variable, owing largely to the number of boats in the fleet making pelagic landings, (see Fig. 6). The fleet has expanded since 1982, but has suffered setbacks in 1987, 1990 and 1991 due to hurricanes.

The average trip length changed dramatically in 1988. From 1983 through 1987, fishing trips averaged 8.7 hours, however from 1988 through 1992, fishing trips averaged only 6.4 hours. The cause of this change is not clear, however it may be reflective of fishermen switching to targeting yellowfin and skipjack.

Figure 8. American Samoa annual estimated inflation-adjusted revenues for commercial landings of all pelagics, tunas and other PPMUS.

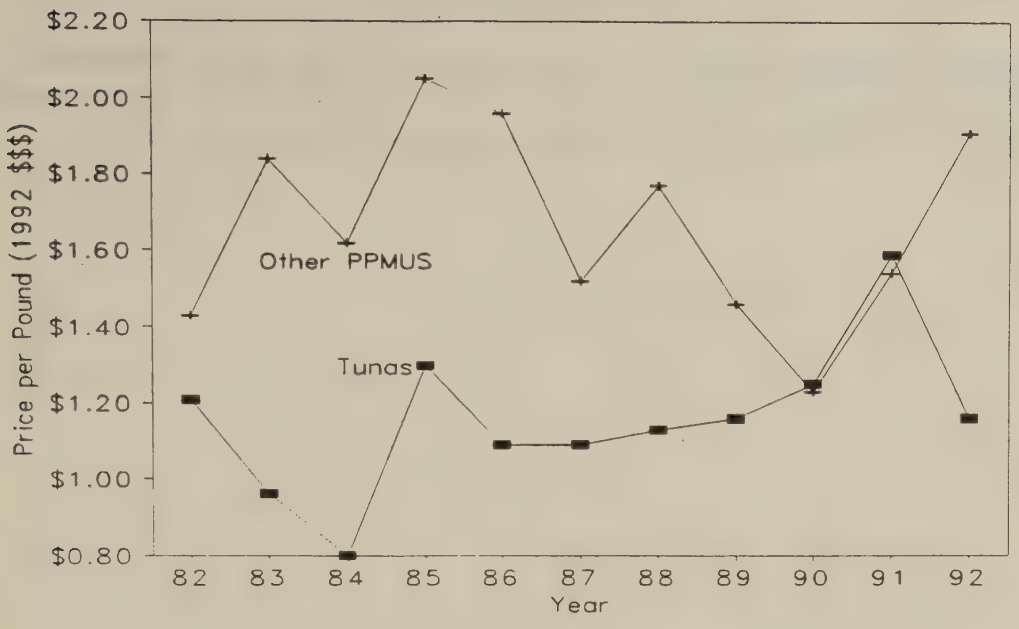


Year	Revenue ($)					
	All Pelagics		Tunas		Other PPMUS	
	Unadjust.	Adjusted	Unadjust.	Adjusted	Unadjust.	Adjusted
1982	21824	30772	18990	26776	1534	2163
1983	66254	92756	58561	81985	5828	8159
1984	153571	210392	114981	157524	15938	21835
1985	131905	179391	95610	130030	26305	35775
1986	173795	229410	142620	188259	30132	39774
1987	123083	155085	115269	145238	7539	9499
1988	178931	218295	155234	189385	20353	24830
1989	131303	153625	114941	134481	12175	14245
1990	66872	72890	59839	65224	5504	5999
1991	110894	115330	97824	101737	10867	11301
1992	137016	137016	110648	110648	22513	22513

Calculation: Revenues from commercial landings for all pelagic species and PPMUS (see Fig. 5) are adjusted for inflation by multiplying a given year's revenue by the quotient of the 1992 consumer price index (CPI) divided by the CPI for that year.

Interpretation: The sharp decline in 1990 revenues is the combined result of reduced prices and landings. Total pelagic revenues recovered in 1991, and in 1992 they reached levels experienced in the mid 1980s. This recovery was primarily due to increased prices of tuna.

Figure 9. American Samoa average price of tunas and other PPMUS.



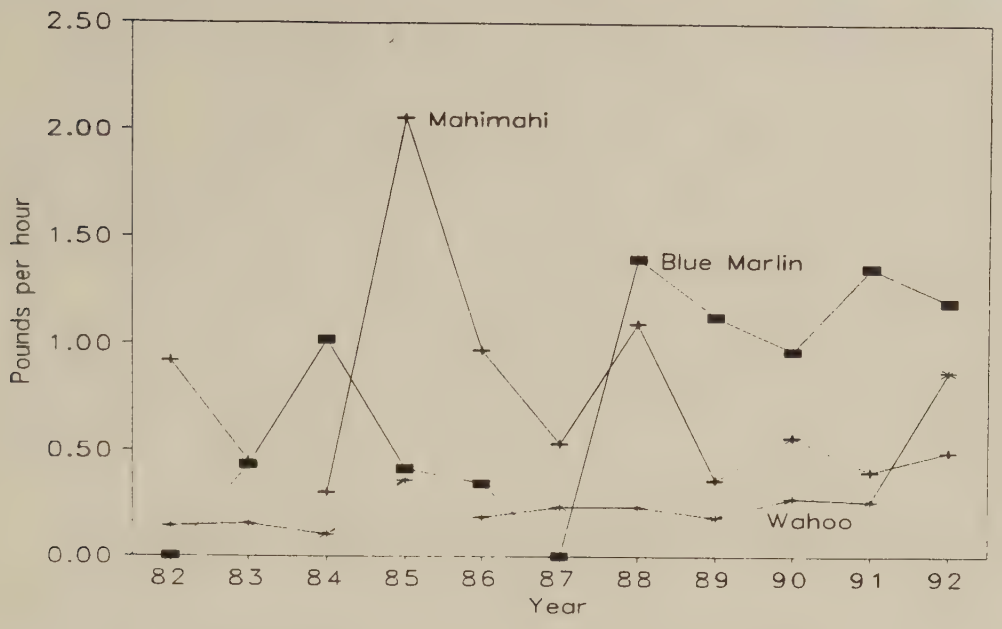
Year	Average Price ($/lb)			
	Tunas		Other PPMUS	
	Unadjust.	Adjusted	Unadjust.	Adjusted
1982	0.86	1.21	1.01	1.43
1983	0.69	0.96	1.31	1.84
1984	0.59	0.80	1.18	1.62
1985	0.95	1.30	1.51	2.05
1986	0.82	1.09	1.49	1.96
1987	0.86	1.09	1.21	1.52
1988	0.93	1.13	1.45	1.77
1989	1.00	1.16	1.25	1.46
1990	1.15	1.25	1.13	1.23
1991	1.53	1.59	1.48	1.54
1992	1.16	1.16	1.91	1.91

Calculation: The average PPMUS price per pound for each year is calculated by dividing the estimated revenue by the estimated weight sold. The adjustment for inflation is made by multiplying the annual average price for a given year by the

1991 consumer price index (CPI) for American Samoa, and dividing by the CPI for the given year.

Interpretation: Fishermen have been getting record high prices for tunas in recent years, although prices dropped in 1992. Prices paid for other PPMUS species recovered from a record low in 1990 to levels seen in the late 1980s.

Figure 10. American Samoa trolling catch rates -- blue marlin, mahimahi and wahoo.

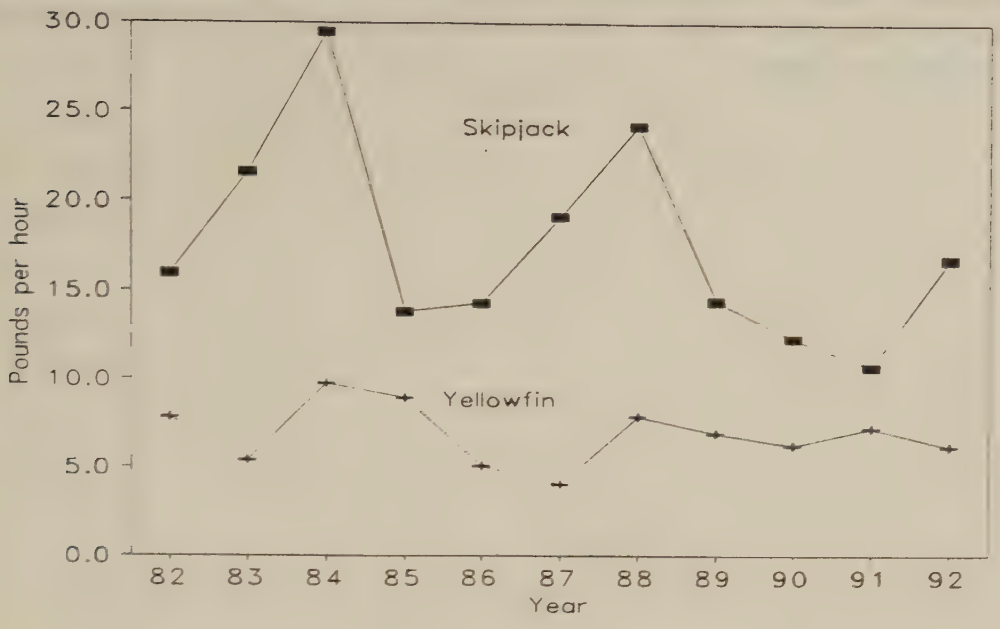


Year	Pounds Caught per Hour Trolling		
	Blue Marlin	Mahimahi	Wahoo
1982	0.00	0.92	0.14
1983	0.43	0.45	0.15
1984	1.02	0.30	0.10
1985	0.41	2.06	0.36
1986	0.34	0.97	0.18
1987	0.00	0.53	0.23
1988	1.40	1.10	0.23
1989	1.13	0.36	0.18
1990	0.97	0.56	0.27
1991	1.36	0.40	0.26
1992	1.20	0.49	0.87

Calculation: For trips that used the trolling method exclusively, and where effort was recorded in hours, the sum of the individual species catch was divided by the sum of trolling hours to obtain CPUE.

Interpretation: CPUE for these species is highly variable. Wahoo CPUE reached an all time high in 1992, and the blue marlin CPUE is near the record high seen in 1988.

Figure 11. American Samoa trolling catch rates -- skipjack and yellowfin tuna.

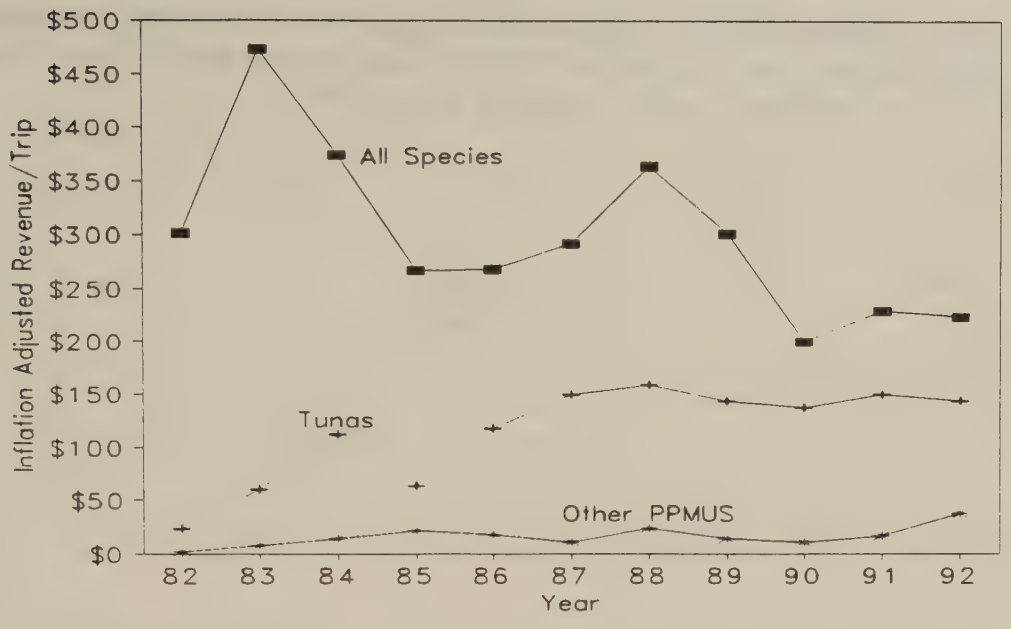


Year	Pounds Caught Per Hour Trolling	
	Skipjack	Yellowfin
1982	15.90	7.80
1983	21.60	5.40
1984	29.50	9.74
1985	13.80	8.90
1986	14.30	5.05
1987	19.10	3.98
1988	24.20	7.85
1989	14.40	6.94
1990	12.30	6.23
1991	10.70	7.23
1992	16.70	6.12

Calculation: For trips that employed the trolling method exclusively and where effort was recorded in hours, the sum of the individual species catch was divided by the sum of trolling hours to obtain CPUE.

Interpretation: Skipjack CPUE has been highly variable through the years. Although catch rates for skipjack fell to a record low in 1991, they appear to have recovered somewhat in 1992. Catch rates for Yellowfin have remained relatively constant in recent years.

Figure 12. American Samoa average inflation-adjusted revenue per trip landing PPMUS.



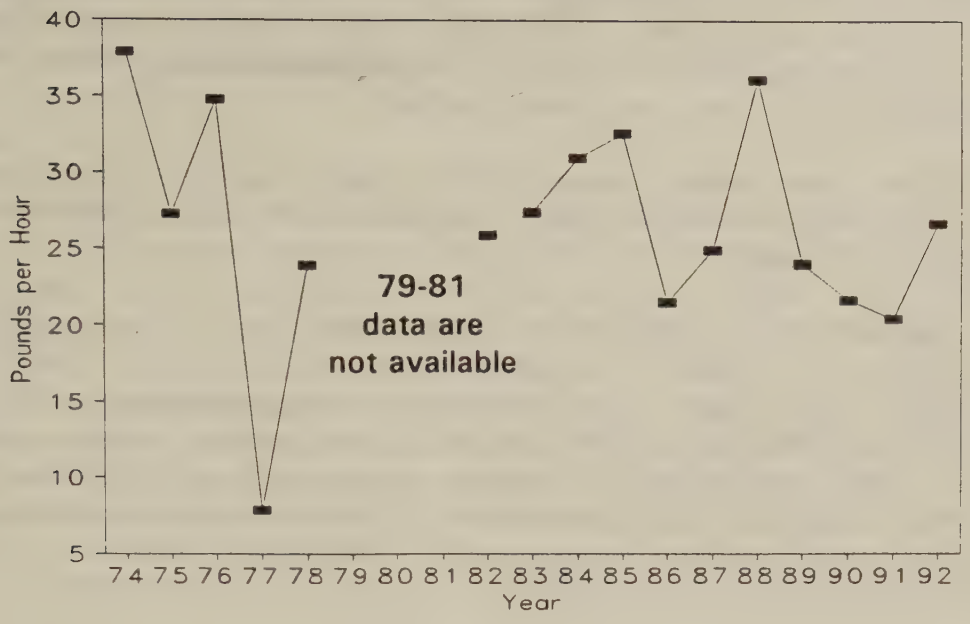
Year	Revenue per PPMUS trip ($)					
	All Species		Tuna		Other PPMUS	
	Unadjust.	Adjusted	Unadjust.	Adjusted	Unadjust.	Adjusted
1982	214	302	16	23	1	2
1983	338	473	43	60	5	7
1984	274	375	82	112	11	14
1985	196	267	47	63	16	21
1986	203	268	90	118	14	18
1987	232	292	119	150	8	10
1988	299	364	131	159	19	24
1989	258	301	123	144	12	14
1990	184	200	126	138	9	10
1991	220	229	144	150	15	16
1992	223	223	144	144	38	38

Calculation: For each trip that landed any PPMUS (excluding longline trips), and which sold at least a portion of their catch, the average PPMUS revenue per trip and average total pelagic species revenue per trip was calculated. The revenues

were adjusted for inflation by multiplying them by the quotient of the 1992 CPI divided by the respective year's CPI.

Interpretation: Revenues per trip plunged to nine-year low in 1990 and recovered only slightly in 1991 and 1992 for all PPMUS species combined. The revenues per trip for tunas has remained nearly constant since 1987.

Figure 13. American Samoa total pelagic catch per hour trolling.



Year	Pounds Caught per Hour	Trips	Data Source
1974	37.90	31	Dory Project
1975	27.30	98	
1976	34.80	10	
1977	7.80	6	
1978	23.90	96	
1982	25.91	104	Commercial Catch Monitoring
1983	27.41	156	
1984	30.97	311	
1985	32.59	193	
1986	21.49	401	Creel Census
1987	24.98	217	
1988	36.17	281	
1989	24.01	372	
1990	21.68	288	
1991	20.41	211	
1992	26.69	206	

Calculation: For trips using only trolling gear and where number of hours fished were recorded, the CPUE (pounds per hour) was summed and divided by the number of trips to get a mean CPUE. Data are from three sources; 1974-78 are from the Dory Project, 1982-84 are from the commercial catch monitoring system, and 1985-91 are from the creel survey program.

Interpretation: Total pelagic species CPUE is predominantly the combined skipjack and yellowfin CPUE shown in Figure 11, as these two species contribute about 85% of the total catch.

Pelagic species CPUE is highly variable, especially in the early years of the American Samoa troll fishery. The extremely low CPUE in 1977 is possibly an artifact of the low number of observations or other data problem. A factor which probably affected the 1990, 1991 and 1992 CPUE was that all but one of the FADs surrounding Tutuila were lost shortly after Hurricane Ofa in February 1990, and that remaining FAD was lost in March of 1992. Plans are to replace the FADs, and this project is expected to begin in April of 1993.

Appendix 1.A (supplemental)

American Samoa Tournament Fishing

Introduction

Several sport fishing tournaments are held on Tutuila each year which are sampled separately from the normal offshore fishery by the DMWR technicians. Often the technicians also function as weigh masters for the tournaments, both to provide independent judging, and to provide DMWR opportunity to collect fisheries data.

Both the tournament rules, prizes and the sampling programs have varied over time, making trend analysis difficult. DMWR technicians collected data on area fished, type and number of gear units, number of fishermen per boat, hours fished and names of fishermen. Some of this information is missing from the interviews, particularly in the earlier years. Where "hours fished" or "number of fishermen" are missing in the data, average values from the remaining data are assumed in this analysis.

Collection of fish weight data was variable. For each tournament fisherman, the largest fish caught of the prize species was always weighed individually. However, the smaller fish were often weighed together by species group.

Tournament prizes have varied, with most tournaments concentrating on large game fish and billfish, such as blue marlin. Many, but not all tournaments also awarded prizes for yellowfin, mahimahi, wahoo, and other species. In later years, tournaments offered separate prizes for the most pounds landed of various species groups.

Tournament fishermen usually keep their catch, however trophy winners are often required to donate part of their catch for a banquet following the tournament.

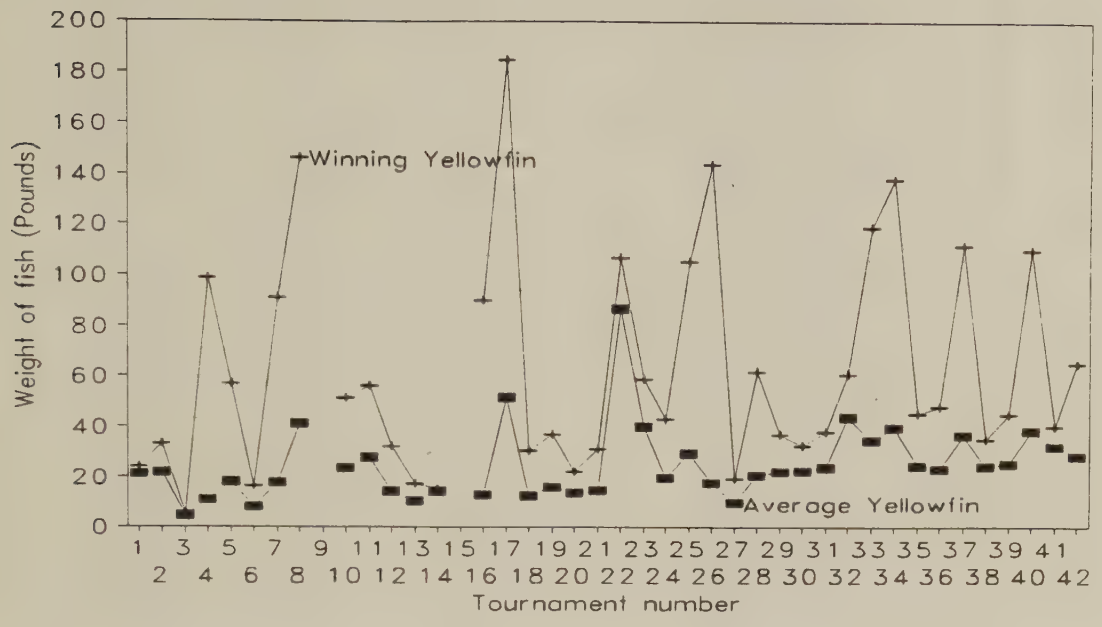
Skipjack tuna were the most often caught fish by number, and second in total pounds of fish landed. However, most tournaments did not include prizes for skipjack tuna, and sampling of these fish was very inconsistent. For this reason, an analysis of tournament skipjack landings is not included in this section.

Recommendations

While data collection on fishing tournaments has improved considerably since 1974, DMWR needs to make modifications to it's sampling program to obtain weight measurements on each fish landed, including skipjack. It would also be highly desirable to also begin to collect length measurements.

Fishermen with small catches often do not report to the weigh in scales at the end of their fishing trips. To encourage fishermen to enter all fish landed, prizes could be awarded to fishermen landing fish of a randomly selected weight or lengths. The randomly selected weight or length would be unknown to both contestants and weigh masters, and announced only after the tournament had ended.

Figure 14. American Samoa fishing tournaments catch: average size and size of largest fish caught -- Yellowfin Tuna.



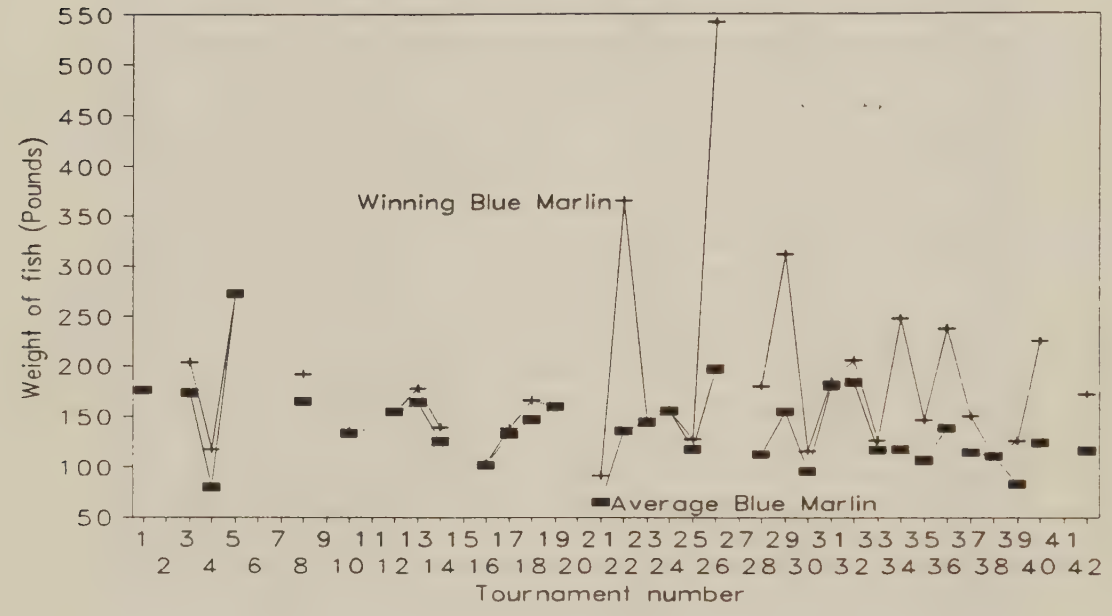
Fishing Tournament		Number Caught	Average Size (lb)	Winning Fish (lb)
Number	Name			
1	THANKSGIVING 74	19	21.0	24.0
2	SCHLITZ CO. 77	12	21.5	33.0
3	NPI TOURN. 1978	2	4.5	5.0
4	KONG YUNG 1978	121	10.5	99.0
5	MEMORIAL DAY 78	36	17.8	57.0
6	O'CONNER 1979	23	7.8	16.0
7	EASTER DAY 79	34	17.5	91.0
8	MEMORIAL DAY 79	4	41.0	146.0
9	LABOR DAY 79	0		
10	VETERANS DAY 79	35	23.5	51.0
11	COLUMBUS DAY 80	7	27.6	56.0
12	4TH JULY 1981	3	14.2	32.0
13	THANKSGIVING 81	16	10.2	17.0
14	PRES. DAY 83	3	14.0	15.0
15	MEMORIAL DAY 83	0		
16	THANKSGIVING 83	61	12.8	90.0
17	PRES. DAY 1984	6	51.6	185.0
18	INDEPENDENCE 84	13	12.4	30.5
19	THANKSGIVING 84	16	15.9	37.0
20	THANKSGIVING 85	16	13.3	22.0
21	PRES. DAY 1986	41	14.4	31.0
22	JULY 4TH 1986	4	86.8	107.0
23	4TH JULY 1987	4	39.9	58.8
24	THANKSGIVING 87	68	19.6	43.0
25	PRES. DAY 1988	19	29.4	105.5
26	FLAG DAY 1988	51	17.6	144.0
27	TOURISM BILL 88	38	9.5	19.3
28	PRES. DAY 1989	105	20.8	62.0
29	GOOD FRIDAY 89	20	21.8	37.0
30	FLAG DAY 1989	27	22.3	32.5
31	TOURISM WEEK 89	10	23.7	38.0
32	TOURISM WK 1990	40	43.9	61.0
33	PRES. DAY 1991	104	34.3	119.0
34	FLAG DAY 1991	152	39.7	138.0
35	TOURISM WEEK 91	78	24.6	45.3
36	MEMORIAL DAY 91	85	23.0	48.0
37	THANKSGIVING 91	41	36.4	111.8
38	FLAG DAY 1992	50	24.2	35.0
39	TOURISM WEEK 92	161	25.3	45.0
40	MEMORIAL DAY 92	118	38.5	110.0
41	JULY 4TH 1992	80	32.1	40.0
42	THANKSGIVING 92	167	28.1	65.0
	TOTAL	1890		
	AVERAGE	45	24.8	62.6
	MAXIMUM	167	86.8	185.0

Calculation: For the table and graph above, yellowfin tuna landings by tournament were summarized. For the computation of average weights, and weight of the

largest fish, only those records where fish were weighed individually were included.

Interpretation: Size of tournament caught yellowfin tuna are highly variable, and no trends are apparent in the data.

Figure 15. American Samoa fishing tournament catch: average size and size of largest fish caught -- Blue Marlin.

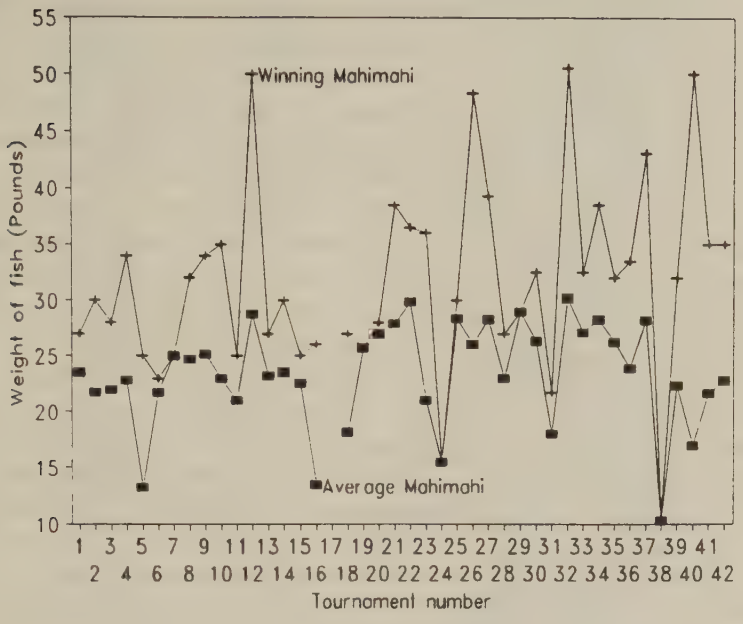


Tournament		Number Caught	Average Size (lb)	Winning Fish (lb)
Number	Tournament name			
1	THANKSGIVING 74	1	176.0	176.0
2	SCHLITZ CO. 77	0		
3	NPI TOURN. 1978	3	173.3	204.0
4	KONG YUNG 1978	3	80.0	117.0
5	MEMORIAL DAY 78	1	272.0	272.0
6	O'CONNER 1979	0		
7	EASTER DAY 79	0		
8	MEMORIAL DAY 79	2	164.5	192.0
9	LABOR DAY 79	0		
10	VETERANS DAY 79	2	132.5	135.0
11	COLUMBUS DAY 80	0		
12	4TH JULY 1981	1	154.0	154.0
13	THANKSGIVING 81	2	164.0	178.0
14	PRES. DAY 83	3	124.7	139.0
15	MEMORIAL DAY 83	0		
16	THANKSGIVING 83	2	101.5	103.0
17	PRES. DAY 1984	2	131.5	138.0
18	INDEPENDENCE 84	2	147.0	166.0
19	THANKSGIVING 84	1	160.0	160.0
20	THANKSGIVING 85	0		
21	PRES. DAY 1986	2	65.4	90.8
22	JULY 4TH 1986	6	135.6	365.0
23	4TH JULY 1987	1	144.0	144.0
24	THANKSGIVING 87	1	155.0	155.0
25	PRES. DAY 1988	3	116.8	126.5
26	FLAG DAY 1988	5	196.7	541.8
27	TOURISM BILL 88	0		
28	PRES. DAY 1989	6	111.6	179.5
29	GOOD FRIDAY 89	7	154.6	311.0
30	FLAG DAY 1989	4	95.6	115.0
31	TOURISM WEEK 89	2	180.8	185.0
32	TOURISM WK 1990	3	184.3	205.5
33	PRES. DAY 1991	2	116.4	125.8
34	FLAG DAY 1991	19	116.8	247.0
35	TOURISM WEEK 91	9	105.9	145.5
36	MEMORIAL DAY 91	3	138.1	236.8
37	THANKSGIVING 91	3	114.0	149.8
38	FLAG DAY 1992	1	110.0	110.0
39	TOURISM WEEK 92	2	82.5	125.0
40	MEMORIAL DAY 92	3	123.3	225.0
41	JULY 4TH 1992	0		
42	THANKSGIVING 92	4	115.5	172.0
	TOTAL	111		
	AVERAGE	3	137.7	184.5
	MAXIMUM	19	272.0	541.8

Calculation: The landings of all blue marlin are tabulated by tournament. For blue marlin which were weighed individually, the average size and largest size fish were computed by tournament.

Interpretation: Tournament prizes encourage fishermen to target blue marlin and other large game fish. In spite of this, of the estimated 5157 fish caught in all tournaments combined, only 111 (2%) were blue marlin. However these made up 17% of total fish landings by weight. There appears to be a decrease in the average size and largest size of blue marlins in recent years.

Figure 16. American Samoa fishing tournament catch: average size and size of largest fish caught -- Mahimahi.

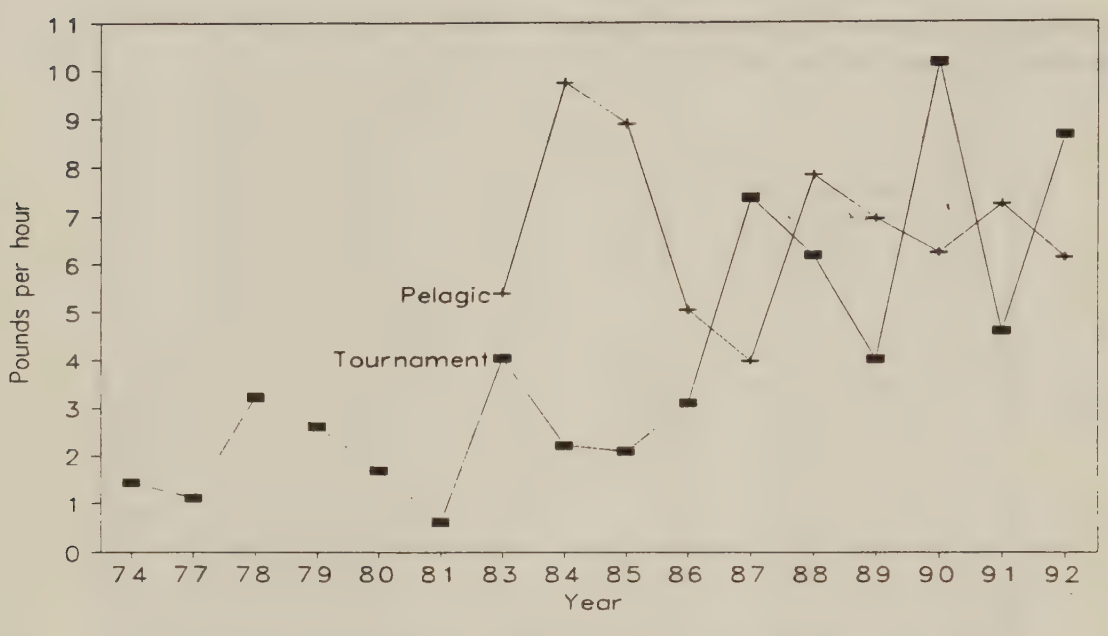


Fishing Tournament		Number Caught	Average Size (lb)	Winning Fish (lb)
Number	Name			
1	THANKSGIVING 74	4	23.5	27.0
2	SCHLITZ CO. 77	9	21.7	30.0
3	NPI TOURN. 1978	16	21.9	28.0
4	KONG YUNG 1978	10	22.8	34.0
5	MEMORIAL DAY 78	12	13.3	25.0
6	O'CONNER 1979	2	21.8	23.0
7	EASTER DAY 79	1	25.0	25.0
8	MEMORIAL DAY 79	11	24.7	32.0
9	LABOR DAY 79	7	25.1	34.0
10	VETERANS DAY 79	8	23.0	35.0
11	COLUMBUS DAY 80	9	21.0	25.0
12	4TH JULY 1981	4	28.8	50.0
13	THANKSGIVING 81	8	23.3	27.0
14	PRES. DAY 83	4	23.5	30.0
15	MEMORIAL DAY 83	2	22.5	25.0
16	THANKSGIVING 83	16	13.5	26.0
17	PRES. DAY 1984	0		
18	INDEPENDENCE 84	3	18.2	27.0
19	THANKSGIVING 84	1	25.8	25.8
20	THANKSGIVING 85	2	27.0	28.0
21	PRES. DAY 1986	8	27.9	38.5
22	JULY 4TH 1986	3	29.8	36.5
23	4TH JULY 1987	10	21.0	36.0
24	THANKSGIVING 87	1	15.5	15.5
25	PRES. DAY 1988	2	28.4	30.0
26	FLAG DAY 1988	15	26.1	48.3
27	TOURISM BILL 88	3	28.3	39.3
28	PRES. DAY 1989	5	23.0	27.0
29	GOOD FRIDAY 89	1	29.0	29.0
30	FLAG DAY 1989	3	26.3	32.5
31	TOURISM WEEK 89	4	18.0	21.8
32	TOURISM WK 1990	8	30.3	50.5
33	PRES. DAY 1991	6	27.1	32.5
34	FLAG DAY 1991	7	28.3	38.5
35	TOURISM WEEK 91	10	26.3	32.0
36	MEMORIAL DAY 91	7	23.9	33.5
37	THANKSGIVING 91	13	28.2	43.0
38	FLAG DAY 1992	1	10.3	10.3
39	TOURISM WEEK 92	11	22.4	32.0
40	MEMORIAL DAY 92	17	17.0	50.0
41	JULY 4TH 1992	3	21.7	35.0
42	THANKSGIVING 92	36	22.8	35.0
	TOTAL	**303**		
	AVERAGE	**7**	**23.4**	**31.8**
	MAXIMUM	**36**	**30.3**	**50.5**

Calculation: The landings of all mahimahi are tabulated by tournament. For mahimahi which were weighed individually, the average and largest size fish were tabulated by tournament.

Interpretation: Size of tournament caught mahimahi tend to be highly variable with no apparent trends in the data.

Figure 17. American Samoa fishing tournaments catch: Yellowfin tuna CPUE by tournament fishermen (with yellowfin CPUE from the offshore pelagic fishery (from Figure 11) also plotted for comparison).

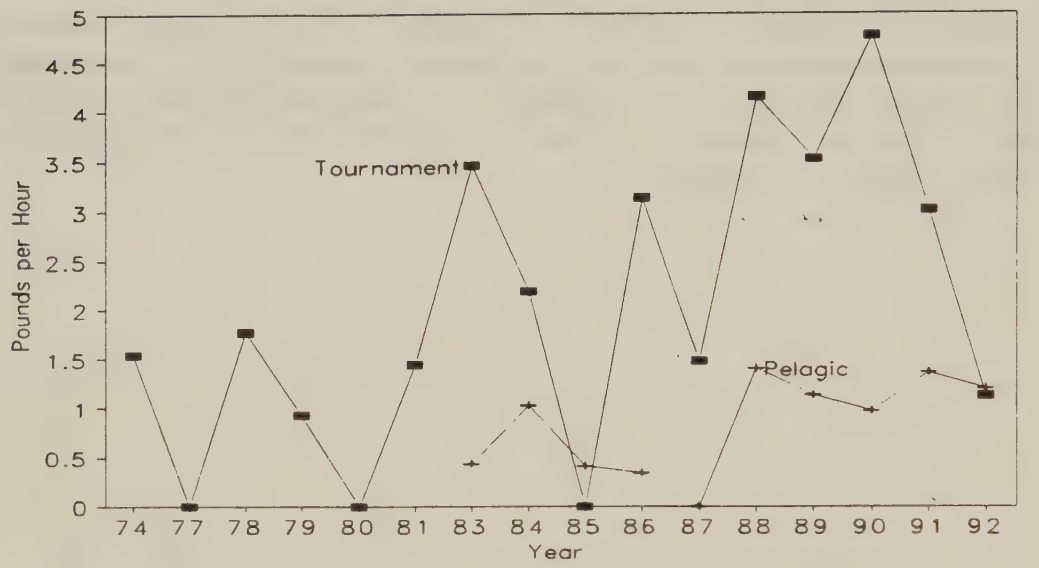


Year	Vessel Hours	Yellowfin Tuna Catch		Pounds/Hour	
		Number	Pounds	Tournament Only	Pelagic Fishery
74	114	19	164	1.43	na
77	229	12	258	1.13	na
78	582	159	1874	3.22	na
79	639	96	1666	2.61	na
80	114	7	193	1.69	na
81	334	19	206	0.62	na
83	167	64	676	4.05	5.40
84	328	35	726	2.21	9.74
85	102	16	212	2.09	8.90
86	302	45	936	3.10	5.05
87	202	72	1493	7.37	3.98
88	321	108	1982	6.18	7.85
89	709	162	2840	4.01	6.94
90	116	40	1177	10.16	6.23
91	1385	460	6361	4.59	7.23
92	985	576	8527	8.65	6.12

Calculation: Vessel hours and landings from the tournament catch data base are tabulated by year. CPUEs for tournament caught yellowfin are computed as the ratio of the total pounds of fish landed divided by the vessel hours. CPUEs for yellowfin taken by non tournament (pelagic) fishermen are computed as discussed in Figure 11.

Interpretation: Yellowfin tuna catch rates were highly variable for both tournament and non-tournament fishermen. Catch rates are comparable for these two fisheries, however there appears to be almost no relationship between the yellowfin catch rates experienced by tournament and non-tournament fishermen. This observation is counter-intuitive, as one would expect to see a similarity in CPUEs between tournament and non-tournament fishing trips in a given year. This lack of correlation between tournament and non-tournament fishing trips may be an artifact of the low sample size in the tournament database, combined with various data collection problems.

Figure 18. American Samoa fishing tournaments catch: Blue marlin CPUE by tournament fishermen (with blue marlin CPUE from the offshore pelagic fishery (from Figure 11) also plotted for comparison).



Year	Vessel Hours	Blue Marlin Catch		Pounds/Hour	
		Number	Pounds	Tournament Only	Pelagic Fishery
74	114	1	176	1.54	na
77	229	0	0	0.00	na
78	582	7	1032	1.77	na
79	639	4	594	0.93	na
80	114	0	0	0.00	na
81	334	3	482	1.44	na
83	167	5	577	3.46	0.43
84	328	5	717	2.19	1.02
85	102	0	0	0.00	0.41
86	302	8	944	3.13	0.34
87	202	2	299	1.48	0.00
88	321	8	1334	4.16	1.40
89	709	19	2496	3.52	1.13
90	116	3	553	4.77	0.97
91	1385	36	4160	3.00	1.36
92	985	10	1107	1.12	1.20

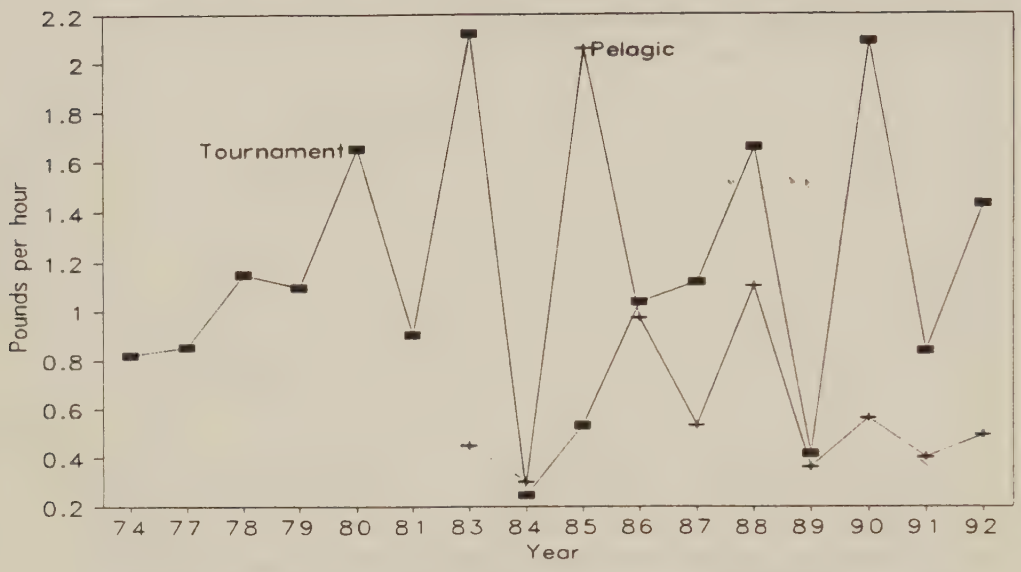
Calculation: Vessel hours and landings from the tournament catch data base are tabulated by year. CPUEs for tournament caught blue marlin are computed as the ratio of the total pounds of fish landed divided by the vessel hours. CPUEs for blue marlin taken by non tournament fishermen are computed as discussed in Figure 10.

Interpretation: Catch rates for blue marlin tend to be considerably higher for tournament fishermen than non-tournament fishermen. Blue marlin are targeted

during the tournaments, as these game fish command the highest prizes and most prestige for the tournaments. Commercially fishermen normally target yellowfin, as they command a higher price and the catch rates are higher than for blue marlin.

The relationship between tournament and non-tournament fishermen CPUEs for blue marlin is better than that for yellowfin.

Figure 19. American Samoa fishing tournaments catch: Mahimahi CPUE by tournament fishermen (with mahimahi CPUE from the offshore pelagic fishery (from Figure 10) also plotted for comparison).



Year	Vessel Hours	Mahimahi Catch		Pounds/Hour	
		Number	Pounds	Tournament Only	Pelagic Fishery
74	114	4	94	0.82	na
77	229	9	196	0.85	na
78	582	38	668	1.15	na
79	639	29	700	1.10	na
80	114	9	189	1.65	na
81	334	12	301	0.90	na
83	167	22	355	2.12	0.45
84	328	4	80	0.24	0.30
85	102	2	54	0.53	2.06
86	302	11	313	1.04	0.97
87	202	11	226	1.12	0.53
88	321	20	532	1.66	1.10
89	709	13	295	0.42	0.36
90	116	8	242	2.09	0.56
91	1385	43	1157	0.84	0.40
92	985	68	1407	1.43	0.49

Calculation: Vessel hours and landings from the tournament catch data base are tabulated by year. CPUEs for tournament caught mahimahi are computed as the ratio of the total pounds of mahimahi landed divided by the vessel hours. CPUEs for mahimahi taken by non tournament (pelagic) fishermen are computed as discussed in Figure 10.

Interpretation: Catch rates for mahimahi are generally higher for tournament fishermen than non-tournament fishermen, except for 1985 when mahimahi were taken by the commercial fleet for export to Hawaii.

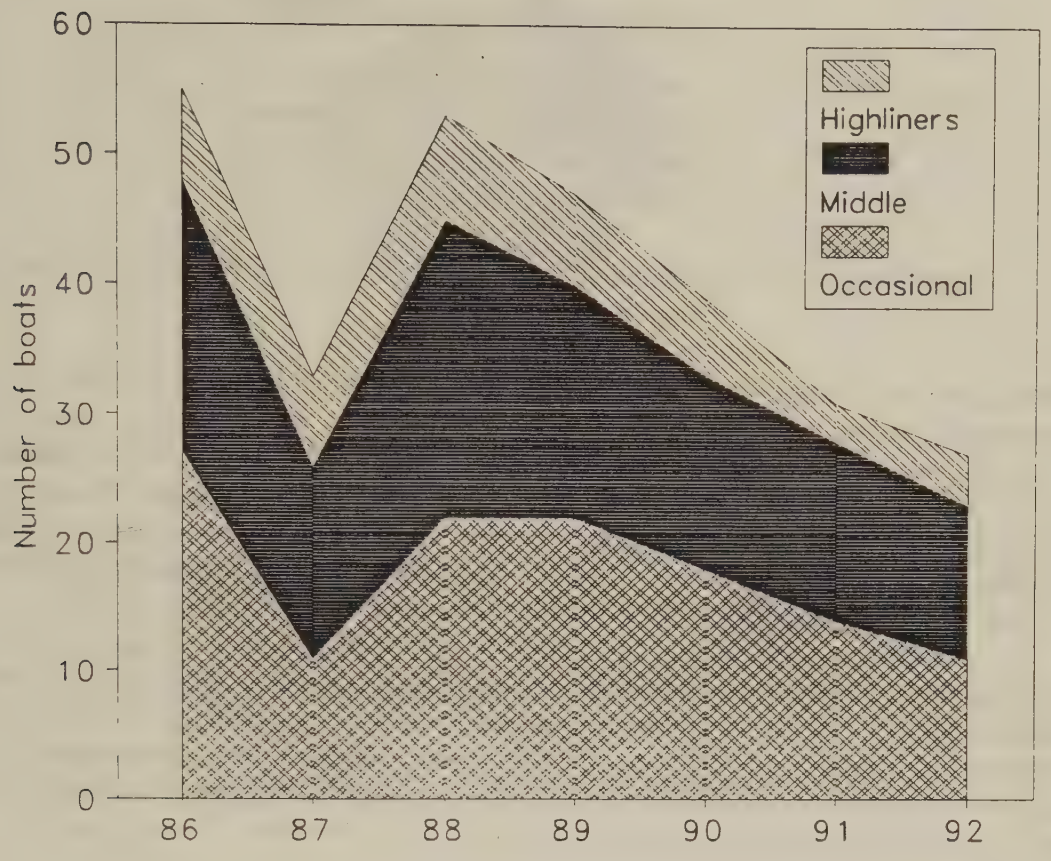
Appendix 1.B (Supplemental)

American Samoa's Artisanal Fishing Fleet, 1986-1992

There has been a general decline in fishing activity in American Samoa by the local fleet since this fishery peaked in the mid-1980s. In 1986, 54 local boats landed catches of pelagic fish, but in 1992 only 27 boats were observed participating in this fishery (Figure 6). The number of boats landing bottom fish species has dropped even more dramatically (Bottom Fish Planning Team 1992 report, Figure AS-4). In 1992, the Pelagic Plan Team recommended that DMWR conduct a survey of American Samoa's local fishing fleet, to determine the cause of this apparent decline. This supplement presents the findings of the survey.

The fleet of large distant water purse seiners and longliners which make landings to the two canneries in Pago Pago harbor are not included in the figures or discussion below. The effort and catch of boats fishing on tournament days are also not included in the figures below.

Figure 20. Number of vessels in the local fishing fleet which made recorded landings of bottomfish and/or pelagic fish, 1986-92.



Vessel classification	Number boats landing fish							
	1986	1987	1988	1989	1990	1991	1992	All Years
Highliner (> 15,000 lb)	7	7	8	7	6	3	4	9
Middle catch (5,000 - 15,000 lb)	21	15	23	18	15	14	12	32
Occasional (< 5,000 lb)	27	11	22	22	18	14	11	71
Total	**55**	**33**	**53**	**47**	**39**	**31**	**27**	**112**

Calculation: Vessel landings and status information are collected on a routine basis by DMWR's data collectors for American Samoa's local fishing fleet. The number of boats which made landings of any pelagic or bottom fish species was tabulated by year, and the surveyed catch was also tabulated by vessel and year. The estimated total catch was obtained by multiplying the surveyed catch for each vessel by the estimated total catch shown in Figure 1 of this report, and Figure 1 of the Bottom Fish report divided by the sum of the surveyed catch by year.

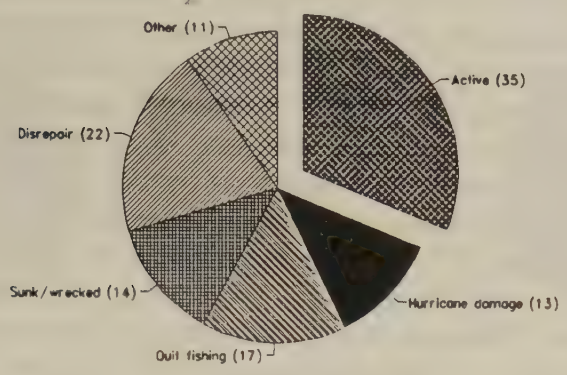
The vessels were categorized according to their maximum annual fishing performance for the period 1986-92. The categories used were as follows:

Highliner	Vessels which landed more than 15,000 lb of fish in any one year from 1986-92.
Middle Catch	Vessels which landed from 5,000 to 15,000 lb of fish in their most productive year from 1986-92.
Occasional	Vessels which landed less than 5,000 lb/yr in all years from 1986-92.

This analysis of fisherman and vessel activity is confounded by the complicated pattern of vessel ownership and usage observed in the territory. Since 1986, many of the vessels have traded hands, often by an owner of one vessel trading up for another. Also, several vessels are owned by one person, but often fished by others. A lack of documentation, and the complicated nature of these transactions makes it very difficult to track the fishing efforts of an individual, and so the analysis presented here is only by vessel.

Interpretation: There has been a marked drop in fishing efforts by the local fleet in recent years. The drop in 1987 was attributed to Hurricane Tusi, which primarily impacted the "occasional" vessels. However, it is now apparent that 1987 was a blip in a long term trend affecting the entire fleet, and that hurricane damage is not the major factor affecting the fishing fleet.

Figure 21. Status of American Samoa's local fishing fleet in 1993. All vessels which were observed fishing from 1986-92 are included in the figure and table below.



112 Vessels Total

Status Code	Vessel Status in Jan. 1993	Number of Vessels			
		Highliner	Middle Catches	Occasional	Total
0	Active fishing vessel in January 1993.	4	12	19	35
1	Not fishing, damaged or sunk by hurricanes.	2	3	8	13
2	Not fishing, quit for economic or other reasons.	1	5	11	17
3	Not fishing, boat sunk or wrecked, non-hurricane related.	2	2	10	14
4	Not fishing, boat in state of disrepair.	0	8	14	22
X	No longer in survey area or not known	0	2	9	11
	Total	9	32	71	112

Calculations: The vessels status was obtained from the 1993 vessel inventory, and through interviews with the DMWR data collectors, who are familiar with the vessels, their owners and the fishermen. Based on this information, a status code was assigned to each vessel as follows; 0 = Vessel is in operational condition and is actively used for fishing (at least occasionally), 1 = Vessel was damaged or destroyed by a hurricane, 2 = Vessel may be operational, but fisherman does not fish anymore for various reasons, 3 = Vessel lost or destroyed by causes other than hurricanes, 4 = Vessel not operational due to maintenance problems, X = Vessel is no longer part of the resident fleet, or it is not known what happened to vessel.

The total surveyed catch by vessel and year was tabulated, and vessels were categorized according to their performance as described in Figure 20.

Interpretation: American Samoa's local fishing fleet consists of a number of small boats, only a few of which could be considered as full-time fishermen. Of the 112 vessels which were observed since 1986, only 35 are still operational and fish at least occasionally. Although 13 vessels were damage or destroyed by hurricanes, 64 vessels have quit fishing for other reasons. Fourteen have sunk, were lost or destroyed by various non-hurricane causes. Another 22 vessels have fallen into a semi-permanent state of disrepair. Another 17 vessels are no longer used for fishing, most of these are dry docked, and have been so for some time. Only one of these 17 is known to still be used for commercial purposes (transporting people and building materials). The owners of the rest are working for the government or businesses. Eleven vessels have left the area, or have been destroyed, and we do not have information on these.

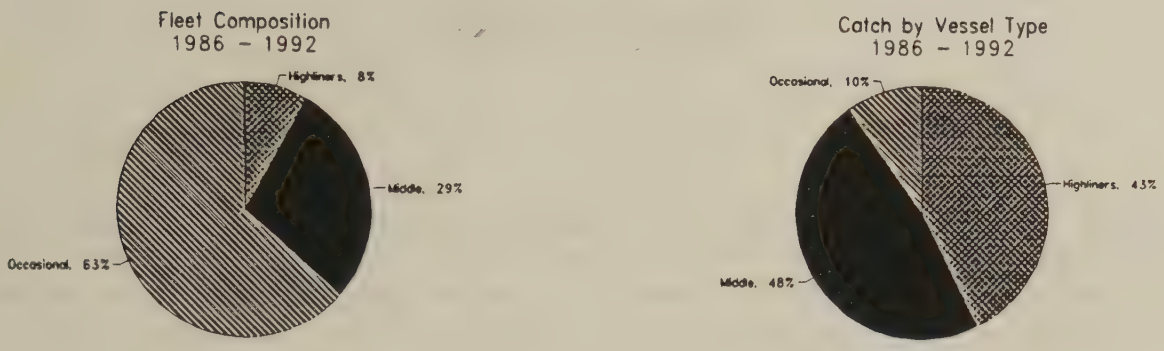
The decline in the fishing fleet is puzzling, as it cannot be explained simply by hurricane damage, or economics. A combination of old age, lack of maintenance, and lack of replacement appear to have reduced the local fishing fleet to its present level.

Data presented elsewhere in this report shows that prices for locally caught fish have held stable even when inflation is accounted for, and fishing CPUEs have held stable, indicating that the fishery can sustain the present levels of fishing pressure.

Market competition with imported fresh fish is apparent. A survey of fresh fish sold in stores has reviled that approximately 80-90% of bottom fish are imported from Western Samoa and Tonga, and from 5% to 65% of the pelagic fish sold in stores were imported in recent years. Store owners complain that the local fleet is too erratic, and the fishermen want too much for their fish. In 1992, stores paid an average of $2.08/lb for imported bottom fish, compared to $2.69/lb for locally caught bottom fish. For pelagic fish, stores paid $1.71/lb for imports, versus $1.96/lb for locally caught fish.

Fishermen face other difficulties in American Samoa as well. There is a lack of adequate maintenance facilities for small vessels, and getting replacement parts and fishing supplies is generally difficult and expensive. Up until 1992 when DMWR installed it's ice machine, there was no convenient supply of ice for local fishermen. The seas surrounding American Samoa are generally rough, making it uncomfortable for persons trying to make a living fishing using the small catamaran style boats used by the local fleet. Local customs also require fishermen to give away portions of their catch to their relatives and village chiefs, making it more difficult to profit from fishing activities.

Figure 21. Fleet composition by vessel type (left), and percentage of total landings by vessel type (right).



Type fisherman/vessel	Number of boats	Percentage of boats	Estimated Catch (lb) 86-92	Percentage of Catch
Highliner (> 15,000 lb in any year)	9	8%	591,762	43%
Middle Catch (5,000-15,000 lb in any year)	32	29%	658,439	48%
Occasional (< 5,000 lb/yr for all years)	71	63%	135,204	10%
Total	112	100%	1,385,405	100%

Calculation: Landings by vessel were summarized, expanded and categorized as described in Figure 20.

Interpretation: The majority of the fishing fleet operates on a part time basis, or are mainly used for sport fishing. The nine "Highliner" fishermen, which make up only 8% of the fleet, account for 43% of all surveyed landings. These nine, and to a lesser extent the 32 "middle catch" vessels, make up the core of the fishing fleet. The remaining 71 "occasional" boats are used primarily for sport fishing

Of the nine "Highliner" vessels, only four were still active in 1993. Of the five vessels no longer fishing, two were destroyed by Hurricane Ofa in 1990, one was wrecked accidentally, one sank in the harbor due to leaks in the hull, two are dry-docked and their owners no longer fish, and one, the DMWR's *Masimasi*, is dry-docked and awaiting repairs.

Appendix 2

Territory of Guam

Introduction and Summary

Guam's pelagic fishery is growing, particularly the charter boat segment. Overall pelagic species landings have varied widely from year to year with an apparent slight increase during the past six years. Landings of non-tuna PPMUS appear are increasing while those of tunas appear to be decreasing. In the early 1980s, the bulk of the catch consisted of tunas, but since 1985 it has consisted of non-tuna, or "Other" PPMUS. A general increase in commercial landings during the past 13 years is attributable to increasing landings of other PPMUS while those of tunas have remained about the same.

There are wide year-to-year fluctuations in the catches of mahimahi, wahoo, and tunas. However, there appears to have been a long-term decline in annual landings of yellowfin tuna from 1985-91, followed by an increase in 1992. Annual landings of blue marlin increased sharply from 1980-90.

Effort in terms of hours and trips has increased since 1983, while hours spent per trip has decreased. This is a reflection of the growing charter segment of the fishery which generally makes half-day rather than full-day trips.

Inflation adjusted revenues for all pelagic species, tunas, and other PPMUS have remained fairly steady during the past 7 years, while inflation adjusted revenue per trip has decreased over the past 9 years.

Annual trolling catch rates have varied widely for all species. However, there seems to have been a general decrease in the catch rate of yellowfin tuna from 1985-91 and an increase in the catch rate of blue marlin from 1980-90. The average size and size of the winning fish for yellowfin tuna caught in the Guam International Fishing Derby decreased from 1979-89, and 1978-89, respectively. The increase in the catch rate of blue marlin may have been due to an increase in the charter boat segment which operates larger vessels more capable of targeting this species. Decreases in the catch rates and size of yellowfin tuna may have been a result of either adverse impacts on their regional stocks by the longline or purse seine fisheries, or decreasing availability due to interception near Guam by the longline or purse seine fisheries.

Inflation-adjusted prices continued to decline in 1992, as they have since at least 1980. The difficulty of obtaining a consistent supply of fresh fish from local fishermen has forced many markets to turn to other sources, at least part of the

time. Some hotels import higher-priced tuna from Japan to meet their demand for sashimi. There is also a wide-spread belief among local fishermen that the flooding of local markets with inexpensive foreign-caught fish in recent years has depressed their ex-vessel prices. There is also evidence that a considerable quantity of low-cost foreign-caught Grade B yellowfin tuna, destined for surface transshipment, enters the local economy illegally.

There were no longliners, domestic or foreign licensed to fish within Guam's EEZ during 1992. Extent of illegal longlining activity is unknown.

Recommendations

1. The Guam Department of Commerce is currently collecting data on foreign longline transshipment through Guam. Relevant data on the stocks should be formatted into an ASCII file and made available on 3.5 inch discs so that it can be accessed by the PT.

2. A program to collect foreign longline vessel data logbooks in Guam should be initiated. All foreign longline vessels fishing, transhipping, or home ported on Guam should be required to submit a daily catch logbook as well as landings and transshipment reports to the Government of Guam and NMFS. A plan should be formulated in order to establish which Government of Guam or NMFS agencies will be responsible for the collection and processing of this data as well as enforcement of this requirement. Although most if not all foreign longline vessels may not be licensed to fish within the Guam EEZ, their fishing activities in adjacent EEZs impact the stocks of pelagic species migrating through the Guam EEZ. Since there is no mechanism available to compel the governments of the Federated States of Micronesia (FSM), Republic of Belau, or the Republic of the Marshall Islands to collect this data or to provide it to the PT, it is necessary for the PT to obtain it by direct means. This should be a Federal as well as Government of Guam requirement, and enforcement should be a Federal as well as Government of Guam responsibility. All costs of this program and its enforcement should be born by the foreign fishing fleet. Therefore a fee and permit system to allow the longline fleet to access Guam port facilities should be implemented. All fees collected should be dedicated to this program.

3. With the inclusion of tuna under the Magnuson Act, it is imperative that catch, effort, and biological data from the domestic and foreign purse-seine fisheries be made available to the PT. Regulations requiring a Federal purse-seine fishing permit, a landings report, a transshipment report, and a daily catch logbook report for all domestic purse-seine vessels fishing, transhipping, or home ported anywhere in the western Pacific Region should be established. These reports should cover all PPMUS whether incidental or

targeted. The same regulations should be established for any foreign purse-seine vessel fishing, transhipping, or home ported in any territory or EEZ governed by the Council. Logbook data are necessary for effective management of this fishery as well as for defining overfishing as required by the revised National Standards. It is critical that a significant enforcement effort be applied to ensure compliance with permit and reporting requirements by all vessels. Compliance and general support among the fishermen would be enhanced if reporting procedures are designed to fulfill both State/Territory and Federal requirements.

4. Support should continue to be supplied to or by the island fisheries offices for collecting data on their pelagic fisheries, including the volume of landings, revenue of sales, fishing effort, and size composition of catch.

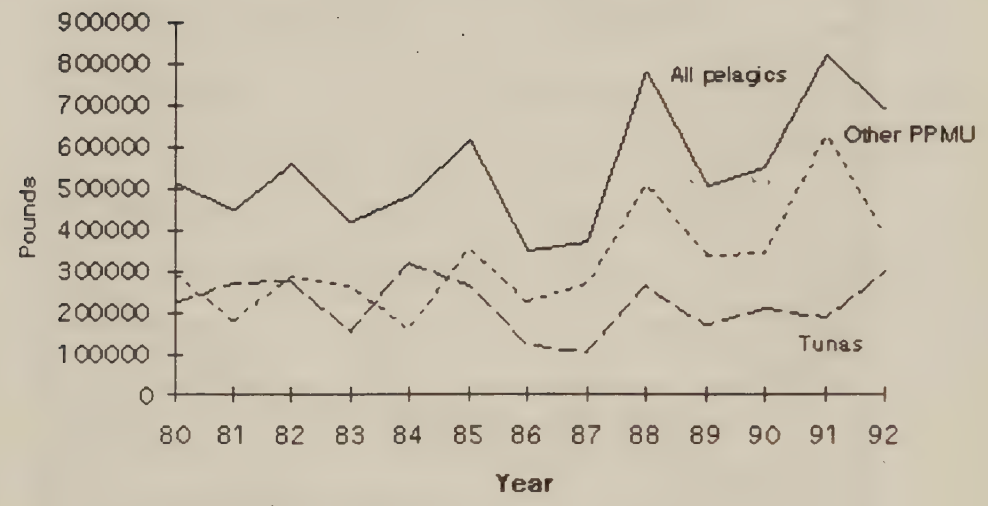
Table 1. Guam 1992 creel survey - pelagic species composition.

Species	Pounds Landed
Sharks	1,838
Mahimahi	136,421
Wahoo	112,872
Blue marlin	127,356
Striped marlin	0
Sailfish	745
Spearfish	204
Dogtooth tuna	950
Double-lined mackerel	46
Subtotal Other PPMUS	**388,634**
Skipjack tuna	138,547
Yellowfin tuna	151,025
Kawakawa	7,113
Tunas (misc)	148
Subtotal Tunas	**296,833**
Rainbow runner	3,613
Barracuda	4,635
Subtotal Misc.	**8,248**
Total Pelagics	**685,513**

Table 2. Guam 1992 annual commercial average price of pelagic species.

Species	Average Price ($/lb)
Mahimahi	1.75
Wahoo	1.91
Dogtooth tuna	1.79
Marlin	0.88
Spearfish	1.83
Sailfish	1.36
Average Other PPMUS	**1.62**
Skipjack tuna	1.11
Yellowfin tuna	2.03
Kawakawa	1.76
Average Tunas	**1.70**
Troll-caught fish	1.50
Rainbow runner	2.29
Barracuda	2.03
Average All Pelagics	**1.66**

Figure 1. Guam annual estimated total landings -- all pelagics, other PPMUS, and tunas.



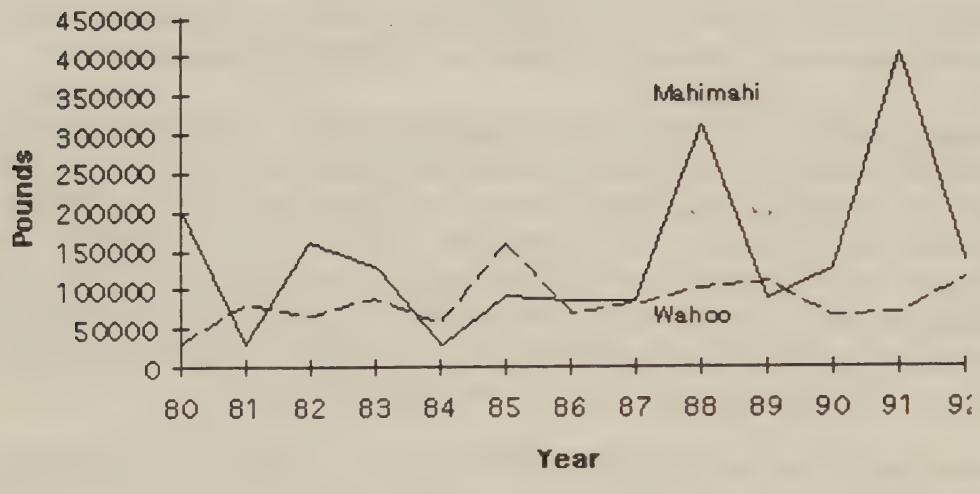
Year	Pounds Landed		
	All Pelagics	Other PPMUS	Tunas
1980	515,631	290,703	224,928
1981	450,813	183,549	267,264
1982	560,046	284,195	275,851
1983	418,222	267,117	151,106
1984	479,134	321,143	157,991
1985	614,520	352,649	261,872
1986	347,673	227,130	120,543
1987	370,586	268,068	102,519
1988	776,336	510,551	265,785
1989	501,880	334,857	167,024
1990	549,944	341,785	208,159
1991	814,786	627,398	187,388
1992	685,513	388,634	296,833

Source: The Division of Aquatic and Wildlife Resources (DAWR) offshore creel sampling program and its associated computerized data expansion system files. The Guam Offshore Expansion System (GOES) and its algorithms are detailed in NMFS Admin. Rep. H-83-21C. For 1992, the GOES was not available and expansions were calculated on a commercially available spreadsheet with Macintosh computers. Details available from DAWR on request.

Calculation: A 362-day (363 days during leap years) expansion is run for each calendar year of survey data and is added to the results of the 3-day Guam International Fishing Derby (GIFD) to produce catch and effort estimates for each fishing method surveyed. Percent species composition is calculated by weight for the sampled catch for each method to produce catch estimates for each species for the expanded period. The annual catch for all pelagic species and the PPMUS separately are summed across all methods to obtain the numbers plotted above except for 1992 which includes only the trolling method.

Interpretation: Guam's pelagic fishery is growing, particularly the charter boat segment which has more than doubled during the past few years. In the early 1980's the bulk of the catch tended to consist of tunas, but since 1985 it has consisted of other (non-tuna) PPMUS. Reasons for this include decreasing size and availability of yellowfin tuna from 1983 to 1989, a lack of interest in skipjack tuna, and an increasing interest in targeting blue marlin. Virtually all landings (97%) are by the trolling method.

Figure 2. Guam annual estimated total landings -- mahimahi and wahoo.



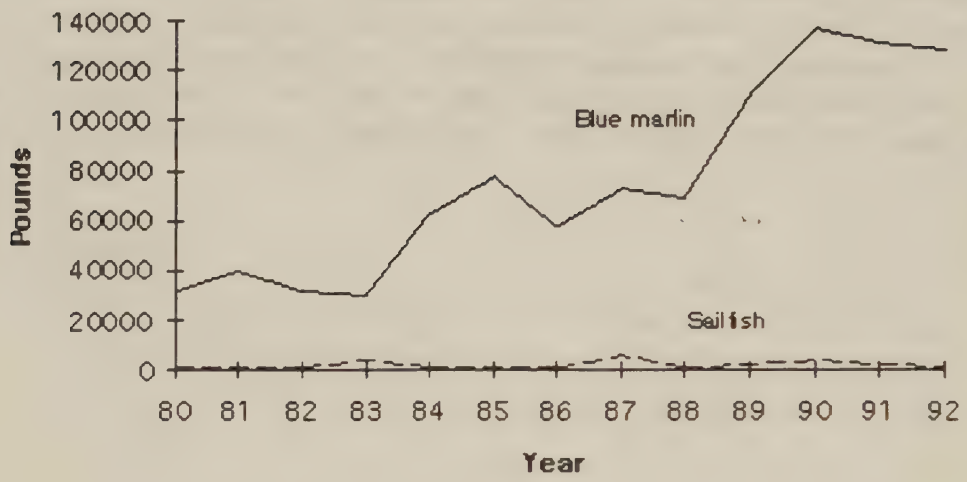
Year	Pounds Landed	
	Mahimahi	Wahoo
1980	203,136	32,825
1981	27,954	82,635
1982	160,200	66,416
1983	128,130	89,010
1984	28,847	56,501
1985	92,407	159,300
1986	85,393	68,830
1987	86,362	82,892
1988	310,032	99,801
1989	87,158	111,977
1990	126,968	66,107
1991	402,107	71,001
1992	136,421	112,872

Source: The Division of Aquatic and Wildlife Resources (DAWR) offshore creel sampling program and its associated computerized data expansion system files.

Calculation: Totals by species are summed across all fishing methods for all years except 1992 as described in figure 1.

Interpretation: Landings of mahimahi exceeded those of all other species during 7 of the past 13 years, making it the most important species in Guam's small boat fishery. The record high landings of mahimahi of 1991 followed by a 66% drop in 1992 is consistent with the long-term pattern of wide fluctuations. Wahoo landings were the highest since 1985. Virtually all landings are by the trolling method.

Figure 3. Guam annual estimated total landings -- blue marlin and sailfish.



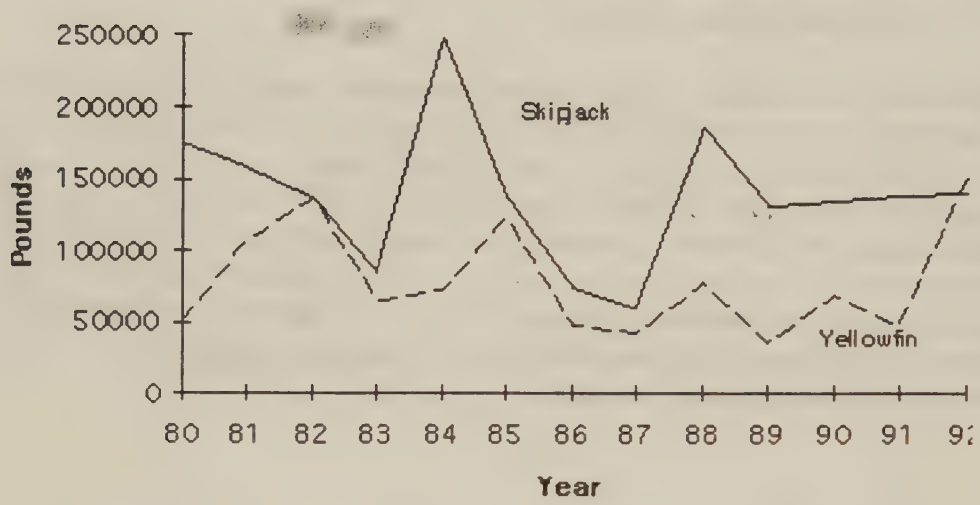
Year	Pounds Landed	
	Blue Marlin	Sailfish
1980	32,192	1,411
1981	40,389	1,272
1982	32,465	1,425
1983	30,359	3,820
1984	63,057	952
1985	77,565	915
1986	57,682	1,474
1987	73,169	5,913
1988	68,511	1,145
1989	109,241	2,191
1990	136,541	3,730
1991	129,992	2,000
1992	127,356	745

Source: The Division of Aquatic and Wildlife Resources (DAWR) offshore creel sampling program and its associated computerized data expansion system files.

Calculation: Totals by species are summed across all fishing methods for all years except 1992 as described in figure 1.

Interpretation: Landings of blue marlin increased steadily between 1980 and 1990, before leveling off during the past three years. Growth was particularly rapid between 1988 and 1990. The rapidly growing charter fleet is undoubtedly the reason for this rapid growth in landings. In 1990, landings of blue marlin exceeded those of all other species, but have since remained slightly below those of mahimahi and skipjack tuna and below that of yellowfin tuna in 1992. Some blue marlin were tagged and released during the past three years and that number is expected to grow. Sailfish landings have remained insignificant. Virtually all landings are by the trolling method.

Figure 4. Guam annual estimated total landings -- skipjack and yellowfin tunas.



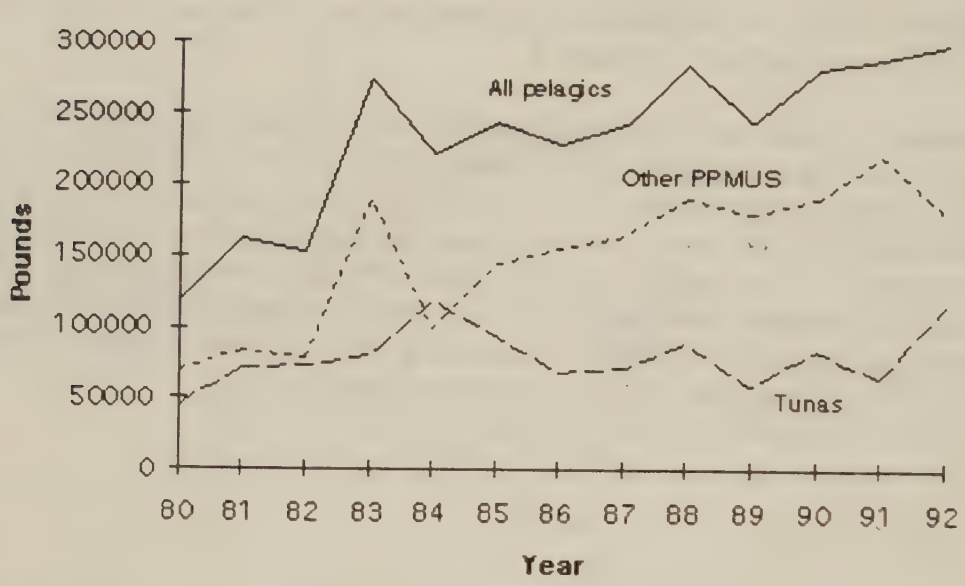
Year	Pounds Landed	
	Skipjack tuna	Yellowfin tuna
1980	175,542	49,386
1981	158,493	107,828
1982	137,735	137,202
1983	85,008	65,598
1984	248,243	71,502
1985	137,097	122,707
1986	73,199	47,290
1987	59,228	41,754
1988	184,838	77,434
1989	130,682	34,404
1990	133,460	68,076
1991	137,136	47,398
1992	138,547	151,025

Source: The Division of Aquatic and Wildlife Resources (DAWR) offshore creel sampling program and its associated computerized data expansion system files.

Calculation: Totals by species are summed across all fishing methods for all years except 1992 as described in figure 1.

Interpretation: Landings of skipjack tuna exceeded those of all other species in four of the last 13 years, and were exceeded by mahimahi in seven of those years. In 1992, landings of yellowfin tuna exceeded those of skipjack tuna for the first time. Previously, landings of skipjack tuna always exceeded those of yellowfin tuna, often by a 2:1 or better margin. Given the poor marketability of skipjack tuna, and the desirability of yellowfin tuna, the availability of skipjack tuna probably exceeds that of yellowfin tuna by a wider margin than this chart would indicate. Virtually all landings are by the trolling method.

Figure 5. Guam annual estimated commercial landings -- all pelagics, tunas, and other PPMUS.



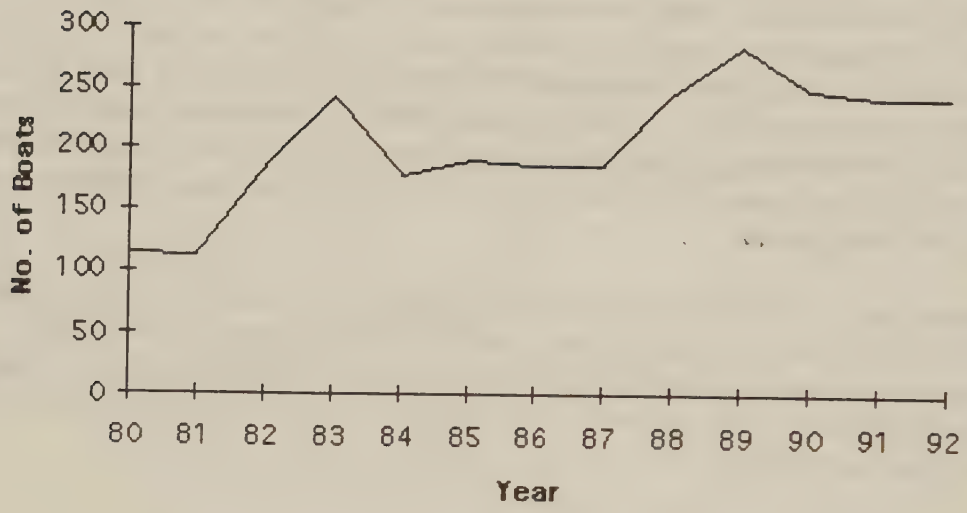
Year	Pounds Landed		
	All Species	Tunas	Other PPMUS
1980	118,275	45,043	70,319
1981	162,186	72,229	84,371
1982	153,577	72,347	77,602
1983	273,120	79,313	189,241
1984	220,074	118,167	98,412
1985	243,060	94,691	143,509
1986	227,928	68,510	154,749
1987	240,790	71,711	163,449
1988	283,264	87,962	188,498
1989	242,554	59,825	178,424
1990	279,121	84,176	190,201
1991	285,696	64,694	218,588
1992	296,809	114,765	178,307

Source: The WPACFIN-sponsored commercial landings system.

Calculation: The total estimated commercial landings for each year were calculated by summing the weight fields in the commercial landings data base for Guam and then multiplying by an estimated percent coverage expansion factor. The annual expansion factor was subjectively created based on as much information as possible depending on the year, including: an analysis of the "disposition of catch" data available from the DAWR offshore creel survey; an evaluation of the fishermen in the fishery and their entry/exit patterns; general "dock side" knowledge of the fishery and the status of the marketing conditions and structure; the overall number of records in the data base; and a certain measure of best guess.

Interpretation: Commercial pelagic fishery landings appears to have increased steadily for the last 13 years. Very few of the fishermen landing fish commercially, however, are full time fishermen. The growing charter boat industry is certainly adding to the growth of the pelagic fishery because nearly all of the charters are for trolling.

Figure 6. Guam estimated number of trolling boats.



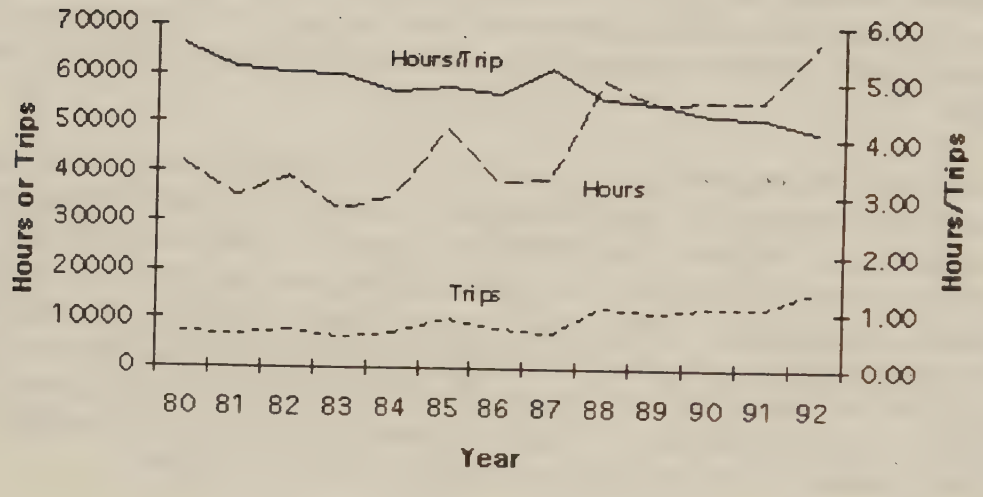
Year	Trolling Boats
1980	115
1981	112
1982	183
1983	240
1984	176
1985	189
1986	184
1987	184
1988	245
1989	282
1990	247
1991	242
1992	242

Source: The Division of Aquatic and Wildlife Resources (DAWR) offshore creel sampling program and its associated computerized data expansion system files.

Calculation: Since only a fraction of the days of the year are actually sampled, it is not possible to know the exact number of boats participating in the fishery. Therefore, a "threshold" C/E model was run a minimum of 15 times per year. The median estimated number of boats was selected from the sorted list of model estimates.

Interpretation: The figures shown here may be an underestimate since only a single site was sampled for most years and a second site was sampled on fewer days for the years 1980-81 and 1989-92. There are undoubtedly boats participating in pelagic fisheries that never utilized the sampled sites during any given year. Prior to 1991, this number was probably less than 50 since there were a limited number of launch sites. With the opening of the Agat Marina in 1991, a larger number of boats were not reached by the survey and the figures given for 1991-2 are unrealistically low. There is a general increase in the number of small boats participating in Guam's fisheries during the past 13 years.

Figure 7. Guam annual estimated pelagic species trips, hours, and hours per trip for trolling.



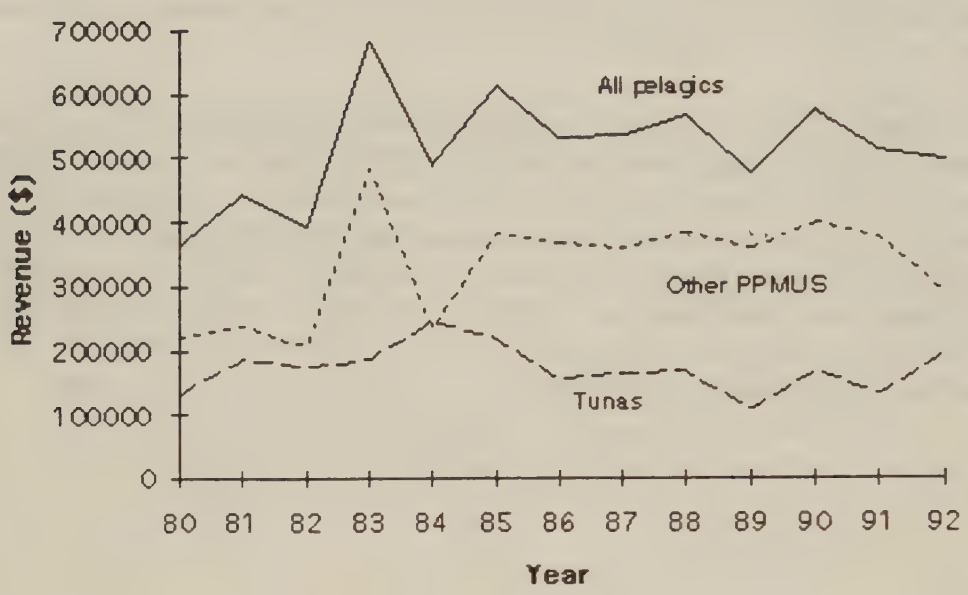
Year	Hours	Trips	Hours per Trip
1980	41,870	7,394	5.7
1981	35,430	6,763	5.2
1982	39,146	7,566	5.2
1983	32,085	6,287	5.1
1984	35,196	7,276	4.8
1985	48,823	9,900	4.9
1986	38,201	7,992	4.8
1987	38,475	7,342	5.2
1988	58,874	12,454	4.7
1989	54,119	11,725	4.6
1990	54,486	12,340	4.4
1991	54,686	12,523	4.4
1992	66,535	16,076	4.1

Source: The Division of Aquatic and Wildlife Resources (DAWR) offshore creel sampling program and its associated computerized data expansion system files.

Calculation: The data expansion system is run on a calendar year's worth of survey data to produce catch and effort estimates for each fishing method surveyed. These plots are of the estimated boat hours spent fishing and number of trips for the trolling method as taken directly from creel survey expansion system printouts.

Interpretation: Guam's pelagic fishery is growing, particularly the charter boat segment which has more than doubled during the past few years. The record high effort as boat hours spent fishing in 1988 was caused by the record high abundance of mahimahi and a rapid expansion of the charter fleet. The leveling off since then is could be due to a number of factors including limited berthing space at the Agana Boat Basin and poor market conditions. Effort is expected to continue its long-term growth. Since most charter trips are for a half-day, mean trip duration has recently decreased.

Figure 8. Guam annual estimated commercial inflation-adjusted total revenues -- all pelagics, tunas, and other PPMUS.



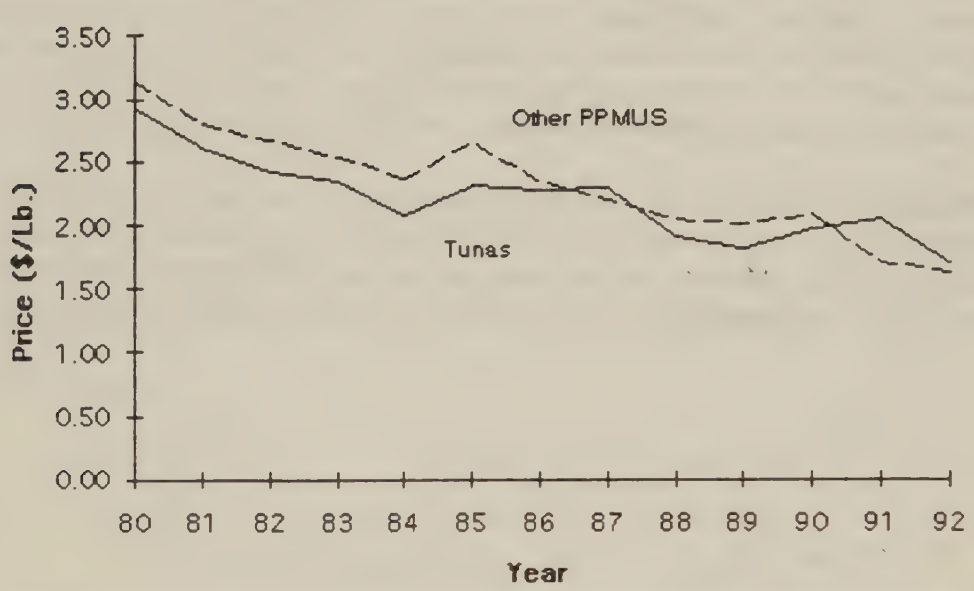
Year	Revenues ($)					
	All Pelagics		Tunas		Other PPMUS	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
1980	149,160	363,801	54,353	132,566	90,623	221,029
1981	218,384	442,447	92,914	188,245	117,052	237,148
1982	203,847	392,814	90,719	174,815	107,573	207,293
1983	364,527	678,749	100,029	186,255	258,501	481,328
1984	283,724	485,736	143,598	245,840	135,498	231,973
1985	369,651	608,815	131,953	217,327	230,855	380,219
1986	330,302	530,135	96,395	154,714	226,935	364,230
1987	347,753	534,497	107,055	164,543	233,116	358,299
1988	386,468	564,630	114,981	167,988	261,901	382,637
1989	337,586	475,321	76,865	108,227	253,932	357,536
1990	471,241	572,087	136,321	165,493	325,372	395,001
1991	462,191	508,972	119,640	131,724	337,328	371,398
1992	492,707	492,707	195,547	195,547	289,129	289,129

Source: The WPACFIN-sponsored commercial landings system.

Calculation: The total estimated revenue for each year was calculated by summing the revenue fields in the commercial landings data base from the principle fish wholesaler on Guam, the Guam Fisherman's Coop, and them multiplying by the same percent coverage expansion factor as were the landings in figure 5.

Interpretation: Revenues for all pelagic species, Tunas, and other PPMUS have remained fairly steady since 1985 with a slight dip in revenues for other PPMUS since 1990. This indicates a declining economic condition of the fishery when one considers that commercial landings for the same period have increased (figure 5).

Figure 9. Guam average adjusted price of tunas and other PPMUS.



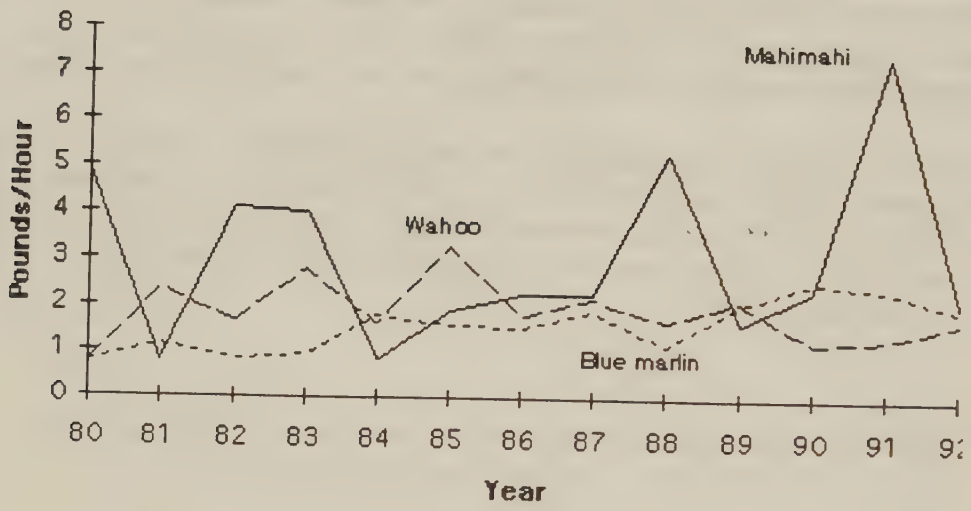
Year	Average Price ($/lb)			
	Tunas		Other PPMUS	
	Unadjusted	Adjusted	Unadjusted	Adjusted
1980	1.21	2.94	1.29	3.14
1981	1.29	2.61	1.39	2.81
1982	1.25	2.42	1.39	2.67
1983	1.26	2.35	1.37	2.54
1984	1.22	2.08	1.38	2.36
1985	1.39	2.30	1.61	2.65
1986	1.41	2.26	1.47	2.35
1987	1.49	2.29	1.43	2.19
1988	1.31	1.91	1.39	2.03
1989	1.28	1.81	1.42	2.00
1990	1.62	1.97	1.71	2.08
1991	1.85	2.04	1.54	1.70
1992	1.70	1.70	1.62	1.62

Source: The WPACFIN-sponsored commercial landings system.

Calculation: The average price of the Tunas and other PPMUS groups are calculated by dividing the total revenue for each by the sold weight. The inflation adjustment is made by using the Consumer Price Index (CPI) for Guam and establishing the 1992 figure as the base from which to calculate expansion factors for all previous years (e.g., divide the 1992 CPI by the CPI of any given year), and then multiplying that factor by the unadjusted average price for the given year.

Interpretation: The inflation-adjusted price of Tunas and other PPMUS shows a general decline during the past 13 years. While the decline does not promote a healthy atmosphere for the commercial fishery, it does not necessarily adversely affect the growing charter boat industry since their success does not directly depend on the price of fish.

Figure 10. Guam trolling catch rates -- mahimahi, wahoo, and blue marlin



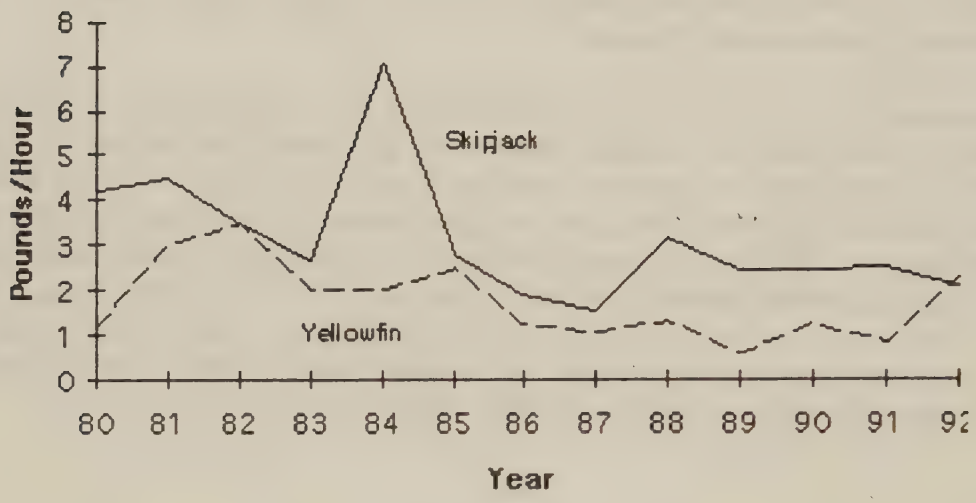
Year	Pounds Caught per Hour Fished		
	Mahimahi	Wahoo	Blue Marlin
1980	4.9	0.8	0.8
1981	0.8	2.3	1.1
1982	4.1	1.7	0.8
1983	4.0	2.8	0.9
1984	0.8	1.6	1.8
1985	1.9	3.3	1.6
1986	2.2	1.8	1.5
1987	2.2	2.2	1.9
1988	5.3	1.7	1.2
1989	1.6	2.1	2.0
1990	2.3	1.2	2.5
1991	7.3	1.3	2.4
1992	2.0	1.7	1.9

Source: The Division of Aquatic and Wildlife Resources (DAWR) offshore creel sampling program and its associated computerized data expansion system files.

Calculation: The data expansion system is run on a calendar year's worth of survey data to produce catch and effort estimates for each fishing method. This plot and table of catch per unit of effort (CPUE) are based on the total annual landings of mahimahi, wahoo, and blue marlin, each divided by the total number of hours spent fishing (gear in use).

Interpretation: The wide fluctuations in CPUE are probably due to the high variability in the year to year abundance and availability of the stocks. However, since it is not possible to allocate species-specific effort, effort used to target other species can also result in artificially high or low catch rates for a given species. No general trend in CPUE is apparent for mahimahi or wahoo. However there does seem to be a general increase in the catch rate of blue marlin between 1980 and 1990. This is probably a result of the rapidly growing charter component of the fleet since the charter vessels tend to be larger than average and tend to target marlin more frequently than the smaller boats.

Figure 11. Guam trolling catch rates -- skipjack and yellowfin tunas.



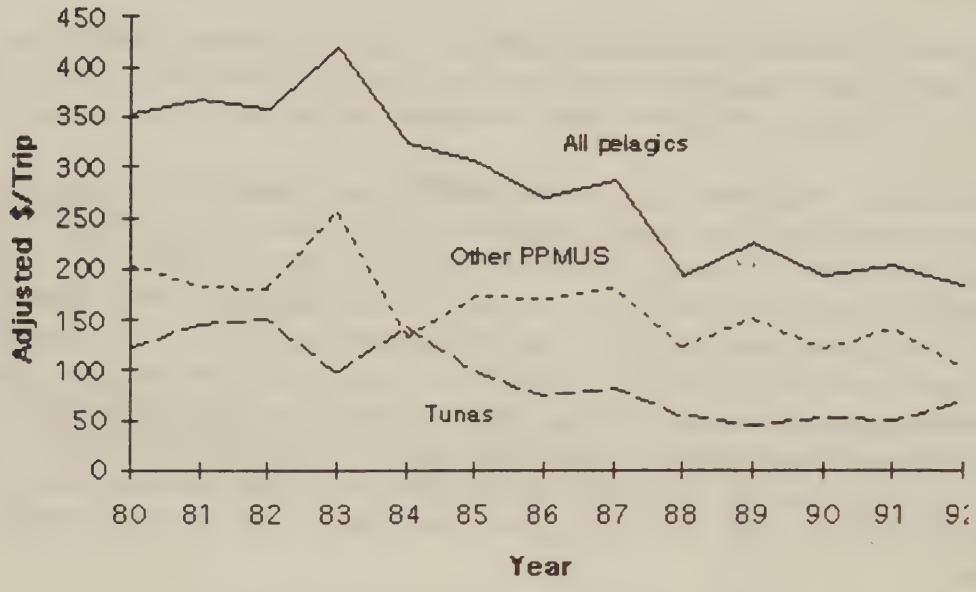
Year	Pounds Caught per Hour Fished	
	Skipjack Tuna	Yellowfin Tuna
1980	4.2	1.2
1981	4.5	3.0
1982	3.5	3.5
1983	2.6	2.0
1984	7.1	2.0
1985	2.8	2.5
1986	1.9	1.2
1987	1.5	1.1
1988	3.1	1.3
1989	2.4	0.6
1990	2.5	1.3
1991	2.4	0.8
1992	2.1	2.3

Source: The Division of Aquatic and Wildlife Resources (DAWR) offshore creel sampling program and its associated computerized data expansion system files.

Calculation: The data expansion system is run on a calendar year's worth of survey data to produce catch and effort estimates for each fishing method surveyed. This plot and table were calculated in the same way as figure 10.

Interpretation: The wide fluctuations in CPUE are probably due to high variability in the year to year abundance and availability of the stocks. However, there does seem to have been a general decline in the CPUE of yellowfin tuna between 1982 and 1991. This could have been the result of either a declining abundance of the stocks, or decreasing availability due to interception by the purse-seine or longline fleets in or near the Guam EEZ, or both. It is also possible that a large annual effort directed at one or more other trolling species by the Guam trolling fleet could result in an artificial decline in the CPUE of the species shown here. If the decline was due to interception by purse-seine or longline fleets, restrictions on their operations in the waters near Guam and its offshore banks could alleviate the problem.

Figure 12. Guam revenues per trolling trip landing tunas and landing any PPMUS.



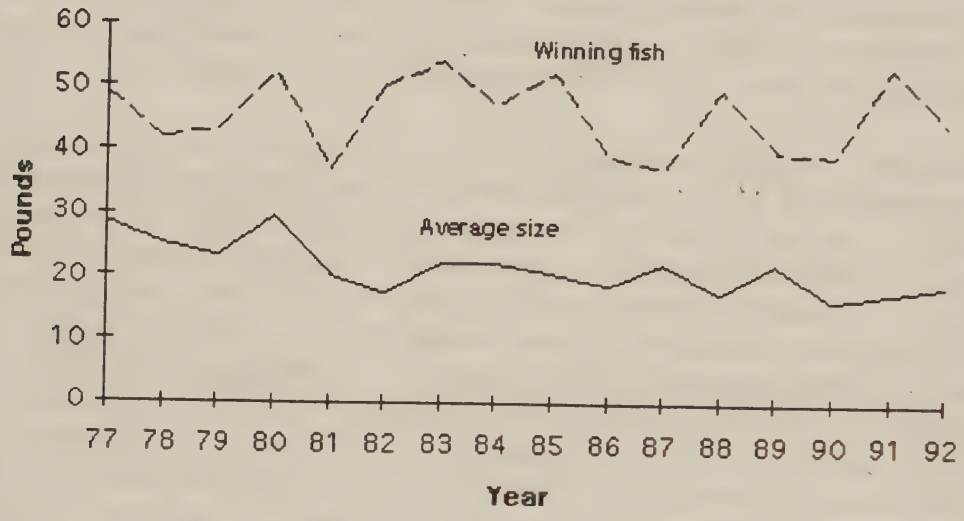
Year	Revenues per Trip ($)					
	All Pelagics		Tunas		Other PPMUS	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
1980	144	352	50	122	84	204
1981	181	366	71	144	89	181
1982	186	358	78	151	93	179
1983	224	418	53	99	137	256
1984	189	323	83	142	78	134
1985	185	305	60	99	105	173
1986	168	269	45	73	107	171
1987	185	285	53	82	116	179
1988	132	192	37	54	83	122
1989	159	224	32	45	107	150
1990	157	191	42	51	99	121
1991	183	202	45	50	127	140
1992	181	181	69	69	102	102

Source: The WPACFIN-sponsored commercial landings system.

Calculation: The average revenue per trip is calculated by summing the revenue of all species sold then dividing by the number of trips, and summing the revenue of all PPMUS sold then dividing by the number of trips, respectively, for any trip which landed any PPMUS. Adjusted revenue per trip is derived from the Guam annual Consumer Price Index (CPI) using 1978 as the base year.

Interpretation: Adjusted revenue per trip for all species, tunas and other PPMUS have experienced a general decline during the past 13 years. This can not be attributed to the trend towards decreasing trip length since the decrease in revenues is considerably greater and since the charter fleet which tends to take shorter trips generally combine daily catches from 2-3 trips onto a single trip receipt. One must be careful in interpreting these data for the Guam fishery because they are subject to biases created by marketing problems and the market structure upon which the data collecting system is based. For instance, 1988 and 1991 were record high years for abundance and landings of mahimahi. One might expect the per trip landings to be high for a year which had record landings. However, because of the glut on the market during the mahimahi season, and because of other marketing problems, the per trip revenue was unusually low. This was partly because purchase limits were placed on fishermen, e.g., only certain fishermen's catches would be purchased (Coop members), and even then a 50-pound maximum limit was often placed on mahimahi. This caused fishermen to either stop fishing at all, stop fishing when they caught 50 pounds, or start marketing some of their catch as elsewhere, which further increased Coop marketing problems.

Figure 13. Guam International Fishing Derby: average size and size of winning fish -- wahoo.



Year	Guam International Derby -- Wahoo		
	Number Caught	Average Size (lb)	Winning Size (lb)
1977	7	28.7	49
1978	9	25.1	42
1979	11	23.2	43
1980	12	29.5	52
1981	60	20.0	37
1982	33	17.6	50
1983	36	22.1	54
1984	46	22.3	47
1985	98	20.7	52
1986	16	18.7	39
1987	31	22.3	37
1988	72	17.3	49.5
1989	59	22.0	39.5
1990	34	16.2	38.9
1991	40	17.4	52.9
1992*	38	18.7	44.0

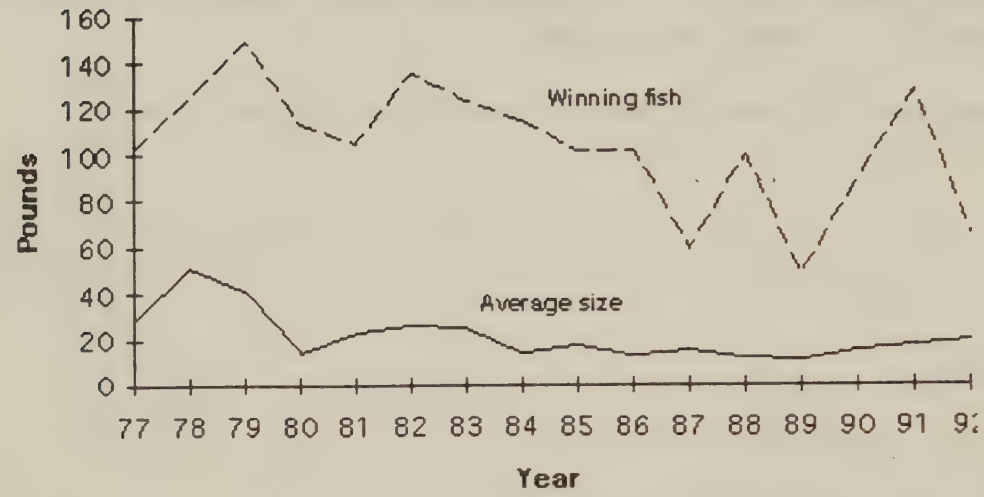
*Third day of derby cancelled; results based on 2 days of fishing.

Source: The Division of Aquatic and Wildlife Resources (DAWR) annual reports.

Calculation: The Guam International Fishing Derby (GIFD) is an annual 3 day event that occurs in July or August. Most of the wahoo caught are measured or weighed by derby officials. The figures here include some fishes whose weights are based on an average or estimate.

Interpretation: No general trend is apparent over the last 15 years.

Figure 14. Guam International Fishing Derby: average size and size of winning fish -- yellowfin tuna.



Year	Guam International Derby -- Yellowfin Tuna		
	Number Caught	Average Size (lb)	Winning Size (lb)
1977	18	29.3	102
1978	11	51.2	125
1979	34	41.2	149
1980	50	13.7	113
1981	109	23.4	105
1982	205	25.6	135
1983	100	24.5	123
1984	59	14.6	114
1985	137	17.0	101
1986	71	12.6	101
1987	116	15.3	59
1988	161	11.6	99
1989	81	10.5	47.5
1990	81	14.9	88.0
1991	102	17.4	127.4
1992*	99	19.8	65.0

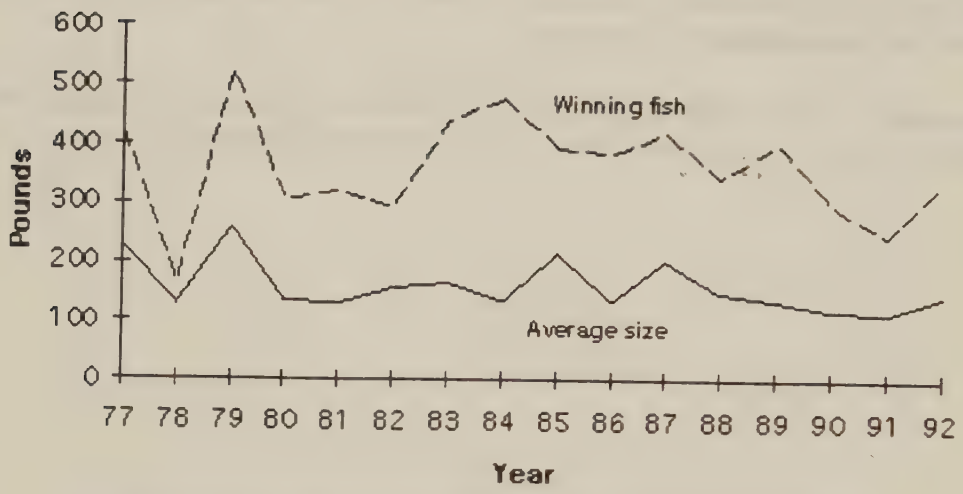
*Third day of derby cancelled; results based on 2 days of fishing.

Source: The Division of Aquatic and Wildlife Resources (DAWR) annual reports.

Calculation: The Guam International Fishing Derby (GIFD) is an annual 3 day event that occurs in July or August. Most of the yellowfin tuna caught are measured or weighed by derby officials. The figures here include some fishes whose weights are based on an average or estimate.

Interpretation: There seems to be a slight recovery in average size during the last three years following a general decline during the previous 10 years.

Figure 15. Guam International Fishing Derby: average size and size of winning fish -- blue marlin.



	Guam International Derby -- Blue Marlin		
Year	Number Caught	Average Size (lb)	Winning Size (lb)
1977	9	228.4	423
1978	9	125.2	166
1979	6	258.4	523
1980	12	133.6	306
1981	34	130.1	320
1982	12	156.6	291
1983	13	163.6	439
1984	47	133.2	475
1985	17	215.2	392
1986	47	134.1	383
1987	43	203.9	415
1988	58	145.7	342.5
1989	86	136.7	402
1990	64	117.9	295
1991	61	112.0	245
1992*	42		142.5

*Third day of derby cancelled; results based on 2 days of fishing.

Source: The Division of Aquatic and Wildlife Resources (DAWR) annual reports.

Calculation: The Guam International Fishing Derby (GIFD) is an annual 3 day event that occurs in July or August. Most of the billfishes caught are measured or weighed by derby officials. The figures here may include a few fishes whose weights are based on an average or estimate.

Interpretation: No general trend is apparent over the last 16 years. However the size of the winning fish and average size have decreased slightly in recent years.

Appendix 3

State of Hawaii - Part A

(includes longline and other pelagic gear)

Introduction

This report contains information from two sources: the Hawaii Division of Aquatic Resources (HDAR) and the National Marine Fisheries Service (NMFS). Estimates for longline landings, CPUE, and revenue came from the NMFS longline logbooks and the NMFS/HDAR wholesale market monitoring programs. Data on troll and handline landings, CPUE, and revenue came exclusively from the HDAR commercial catch reporting system. Historical troll and handline data in Appendix 3 (for 1987-91) were revised using HDAR data to maintain consistency with 1992 data. Therefore, information reported in previous annual reports are not directly comparable to this 1992 report. In addition, NMFS estimates of 1992 longline landings were revised using 1992 average weights. Figures on longline landings were estimated by the NMFS using a procedure explained more fully in the NMFS report, Western Pacific Pelagic Fisheries in 1991[1].

Appendix 4 contains the State of Hawaii's (HDAR) report on non-longline pelagic catches, a summary of the 1992 Hawaii fishery, and Hawaii's recommendations.

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[1] Ito, Russell Y. 1992. Western Pacific Pelagic Fisheries in 1991. NMFS Southwest Fisheries Science Center, Honolulu Laboratory, Administrative Report H-92-15.

Table 1. Hawaii domestic pelagic landings, revenue and prices, 1991 and 1992 (preliminary).

Species	1991			1992		
	Pounds Landed (x 1,000)	Revenue (x $1,000)	Ave. Price ($/lb)	Pounds Landed (x 1,000)	Revenue (x $1,000)	Ave. Price ($/lb)
Swordfish	9,914	22,029	2.22	12,643	24,279	1.92
Blue marlin	1,469	1,024	0.70	1,305	1,311	1.00
Striped marlin	1,490	1,481	0.99	1145	1,448	1.26
Other billfish	454	343	0.76	317	340	1.07
Mahimahi	1,281	2,087	1.63	1,119	1,969	1.76
Wahoo	483	1061	2.20	380	965	2.54
Sharks	222	104	0.47	574	354	0.62
Non-Tuna PPMUS Subtotal	**15,313**	**28,129**	**na**	**17,483**	**30,666**	**na**
Bigeye tuna	3,678	12,799	3.48	3,463	12,190	3.52
Yellowfin tuna	3,713	8,103	2.18	2,989	6,223	2.08
Albacore	859	1,043	1.21	896	1,081	1.21
Other tunas	2,833	3,528	1.25	2,989	3,447	1.58
Tuna Subtotal	**11,083**	**25,474**	**na**	**9,527**	**22,941**	**na**
Other pelagics	508	711	1.40	380	613	1.61
TOTAL	**26,904**	**54,314**	**2.02**	**27,390**	**54,220**	**1.98**

Source and Calculation: NMFS estimates based on federal longline logbooks (number landed) and shoreside monitoring (average weight per fish) by NMFS and HDAR, and HDAR commercial catch reports for non-longline gears. Totals were calculated by summing separate estimates for longline, baitboat (pole-and-line or aku boat), main Hawaiian Islands (MHI) troll and handline, and Northwestern Hawaiian Islands (NWHI) landings. Detailed information on the estimation procedure is available in Ito (1992). Numbers rounded to nearest 100,000. The columns may not sum precisely due to rounding.

Table 2. Hawaii pelagic landings and revenue by gear, 1991 and 1992.

Gear	Pounds Landed (x 1,000)	Pounds Sold (x 1,000)	Revenue (x $1,000)	Average Price ($/lb)
1991				
Baitboat	2,232	2,226	2,815	1.26
Handline	1,863	1,811	3,139	1.73
Longline	19,600	19,600	43,700	2.23
Trolling	3,203	2,728	4,657	1.71
Other	6	2	4	1.56
TOTAL	**26,906**	**26,368**	**54,314**	**2.06**
1992				
Baitboat	1,735	1,725	2,415	1.40
Handline	1,939	1,897	3,229	1.70
Longline	21,240	21,240	44,650	2.10
Trolling	2,473	2,093	3,920	1.87
Other	4	2	5	2.06
TOTAL	**27,391**	**26,958**	**54,219**	**2.01**

Source and Calculation: NMFS estimates and HDAR commercial catch report data, as in Table 1 notes. Pelagic species only. 1992 data are preliminary.

Table 3. Hawaii longline landings, catch per unit effort, and revenue, 1991 and 1992 (preliminary).

Species	1991			1992		
	Landings (x 1,000 lb)	CPUE (No. caught per 1000 hooks)	Revenue (x $1,000)	Landings (x 1,000 lb)	CPUE (No. caught per 1000 hooks)	Revenue (x $1,000)
Blue marlin	700	0.73	500	730	0.39	591
Swordfish	9,900	5.38	22,000	12,640	6.36	24,270
Striped marlin	1,400	1.48	1,400	1060	1.37	1360
Other billfish	400	0.76	300	280	0.48	300
Mahimahi	500	3.21	700	590	4.85	830
Wahoo	100	0.22	200	80	0.21	200
Sharks	200	5.78	100	560	8.12	350
Non-Tuna PPMUS Subtotal	**13,200**	**na**	**25,200**	**15,940**	**na**	**27,901**
Bigeye tuna	3,500	3.31	12,500	3,280	3.74	11,910
Yellowfin tuna	1,600	1.08	4,300	770	0.67	2,310
Albacore	700	1.14	900	780	1.69	970
Other tuna	100	0.35	100	100	0.30	680
Tunas Subtotal	**5,900**	**5.88**	**17,800**	**4,930**	**6.41**	**15,870**
Misc. pelagics	500	0.72	700	370	0.92	600
TOTAL	**19,600**	**na**	**43,700**	**21,240**	**na**	**44,650**

Source and Calculation: NMFS estimates based on NMFS longline logbook data and NMFS-HDAR shoreside monitoring data. 1992 data are preliminary. The numbers may not sum precisely due to rounding.

Table 4. Hawaii pelagic fresh and frozen seafood imports and exports by product form, 1991.

Species	Imports (lb)			Exports (lb)		
	Round	Fillet	Total	Round	Fillet	Total
Billfish	9,557		9,557			
Mahimahi	157,531	3,638,956	3,796,487			
Other	12,773		12,773			
Shark						
Swordfish	425		425			
Wahoo	134,779		134,779			
Non-Tuna PPMUS Subtotal	**315,065**	**3,638,956**	**3,954,021**			
Albacore	129,124	2,132	131,256			
Bigeye	361,653	2,500	364,153			
Bluefin	646		646	177,992		177,992
Bonito	6,006		6,006			
Unclass.				48,501		48,501
Skipjack	230,698	109,943	340,641			
Yellowfin	595,274	214,194	809,468	801,998		801,998
Tunas Subtotal	**1,323,401**	**328,769**	**1,652,170**	**1,028,491**		**1,028,491**
TOTAL	**1,638,466**	**3,967,725**	**5,609,191**	**1,028,491**		**1,028,491**

Source: NMFS Southwest Region.

Table 5. Average size of fish (in pounds), by gear type, 1987-1992.

Year	Non-Tuna PPMUS					Tunas			
	Swordfish	Blue marlin	Striped marlin	Mahimahi	Wahoo	Bigeye	Yellowfin	Albacore	Skipjack
Longline									
1987	129.3	161.4	66.2	21.1	33.3	76.3	81.9	62.3	--
1988	119.2	157.3	56.9	20.0	31.9	83.2	102.5	59.7	--
1989	131.1	164.7	61.5	23.0	34.6	77.0	103.7	62.0	--
1990	147.6	198.4	61.5	18.7	36.0	79.8	121.9	61.2	--
1991	142.4	172.0	55.8	14.5	31.6	85.5	117.2	53.3	--
1992	177.9	166.9	69.1	11.0	35.0	76.7	100.5	48.0	--
Troll and Handline									
1987	--	212.1	67.3	18.8	19.5	19.6	27.6	--	8.9
1988	--	181.6	60.3	17.2	21.1	58.9	31.5	--	11.1
1989	--	185.7	67.9	19.9	20.9	34.0	35.4	--	13.6
1990	--	243.3	74.8	19.1	21.9	25.3	51.6	--	10.6
1991	--	179.2	60.6	13.5	18.8	20.4	26.0	--	14.5

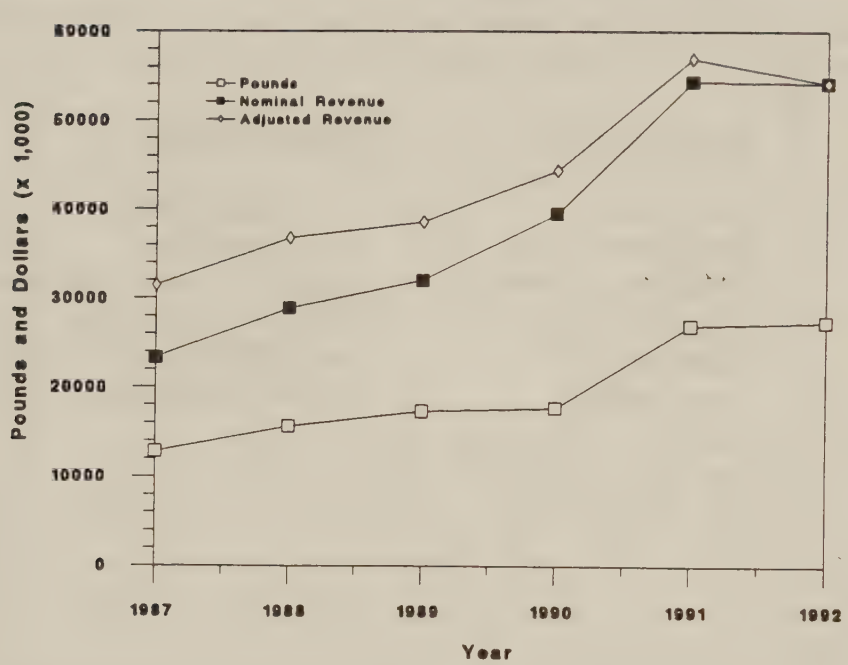
Source and Calculation: NMFS and HDAR shoreside monitoring program. Average weights are the averages of shoreside monitoring samples. 1992 weights are preliminary estimates.

Table 6. Additional pelagic species caught by Hawaii-based vessels.

These species are not currently management unit species (PPMUS). Several are proposed to be added to the management unit when the FMP is next amended.

Common name	Scientific name
Barracuda	*Sphyraena barracuda*
Moonfish (opah)	*Lampris regius*
Oilfish (smooth)	*Lepidocybium flavobrunneum*
Oilfish (rough)	*Ruvettus pretiosus*
Pomfrets	family Bramidae
Medusafish	*Hyperglyphe japonica*

Figure 1. Hawaii pelagic landings and revenue.



Year	Pounds (x 1,000)	Revenue (x $1,000)	
		Nominal	Adjusted
1987	12,800	23,300	31,500
1988	15,600	28,900	36,800
1989	17,300	32,000	38,600
1990	17,700	39,500	44,400
1991	26,900	54,300	56,900
1992	27,400	54,200	54,200
Average	19,600	38,700	43,700

Source and Calculation: Landings and revenue data are collected by NMFS and HDAR. See notes to Tables 1 and 3 for estimation procedures. Nominal revenue is converted to inflation-adjusted revenue (1992 level) with the Honolulu Consumer Price Index[2]. Estimates are rounded to nearest 100,000 pounds or dollars. The numbers may not add up due to rounding.

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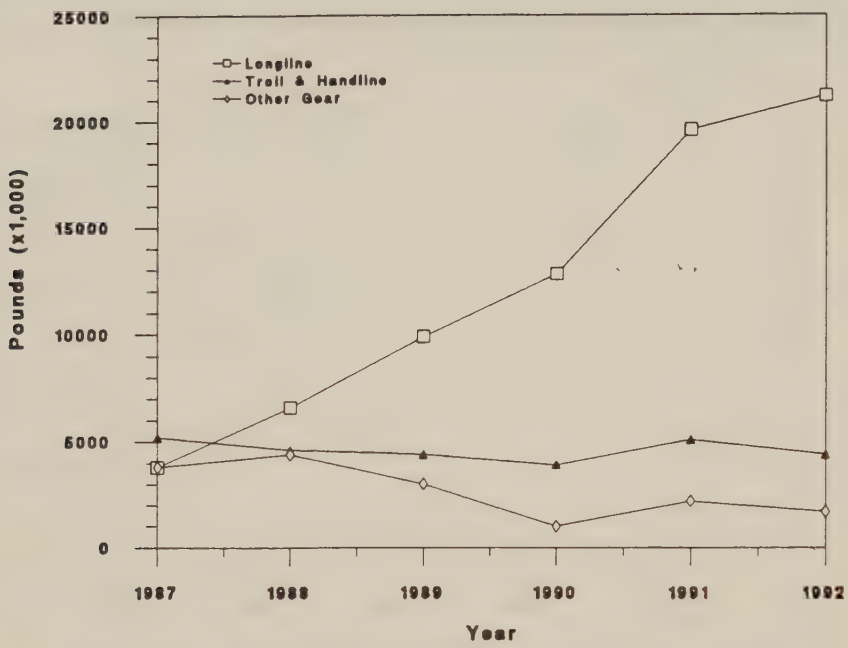
[2] State of Hawaii Data Book 1992: A statistical abstract. Department of Business, Economic Development and Tourism. Table 411, page 369.

Interpretation: Total pelagic harvest increased by 2% in weight and decreased 5% in adjusted revenue from the previous year. However, landings increased 40%, and adjusted revenue increased 24% over the 6-year average.

Figure 2. Hawaii total pelagic landings by gear type.

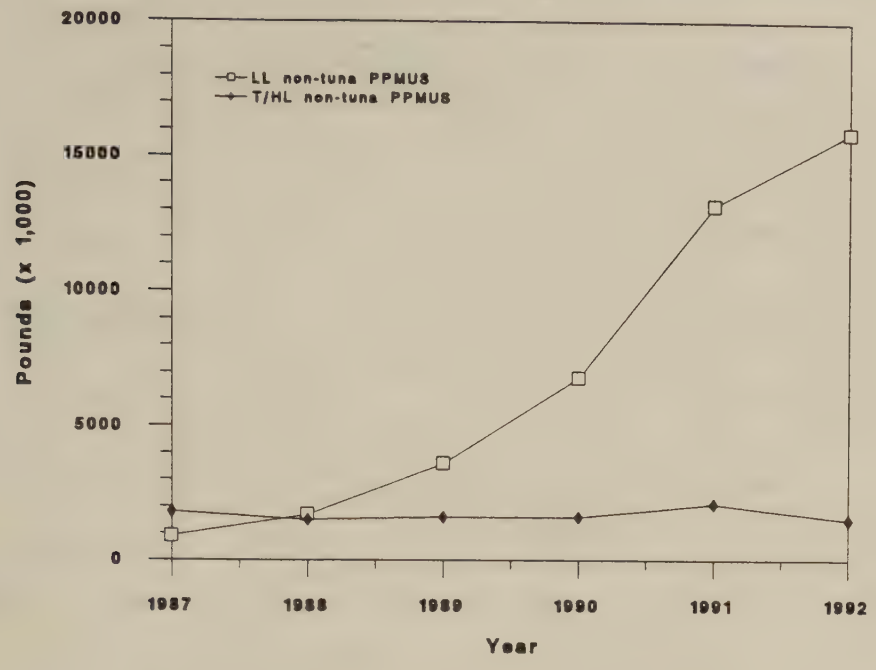


Year	Pounds landed (x 1,000)		
	Longline	Troll & Handline	Other Gear
1987	3,800	5,200	3,800
1988	6,600	4,600	4,400
1989	9,900	4,400	3,000
1990	12,800	3,900	1,000
1991	19,600	5,100	2,200
1992	21,200	4,400	1,700
Average	12,300	4,600	2,700

Source and Calculation: Landings data are collected by the NMFS and HDAR. See notes to Tables 1 and 3 for estimation procedures. Estimates are rounded to the nearest 100,000 pounds. The numbers may not add up due to rounding.

Interpretation: Longline landings increased again in 1992, but by a modest amount (8%) compared to 1990 and 1991. Troll and handline landings decreased 14% from 1991 and was below the 1987-92 average. Landings of other gear (primarily pole-and-line) also decreased (22%), was well below the average, and continues a long-term decline in the pole-and-line fishery.

Figure 2a. Hawaii other (non-tuna) PPMUS landings by gear type.

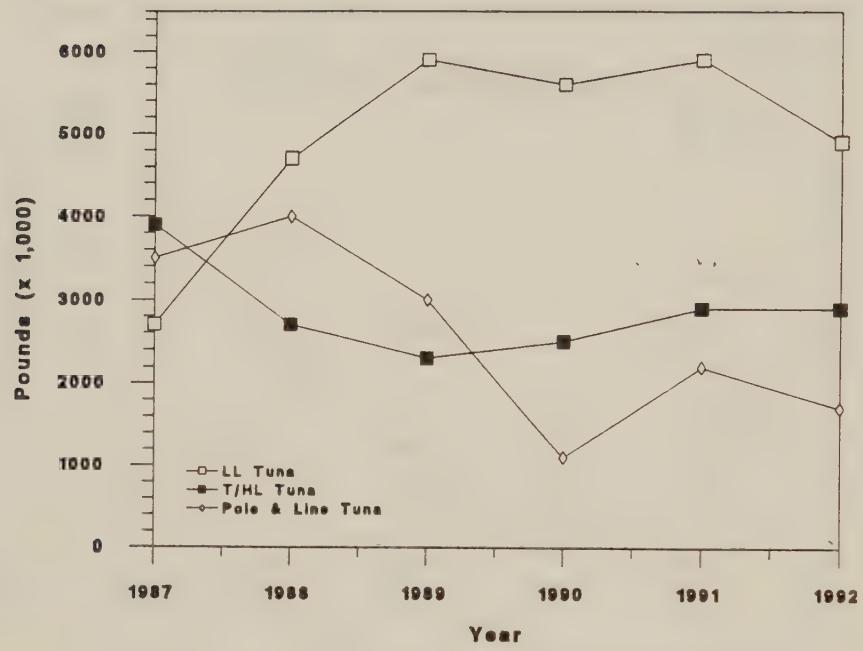


Year	Pounds Landed (x 1,000)	
	Longline	Troll & Handline
1987	900	1,800
1988	1,700	1,500
1989	3,600	1,600
1990	6,800	1,600
1991	13,200	2,100
1992	15,900	1,500
Average	7,000	1,700

Source and Calculation: Landings data are collected by the NMFS and HDAR market monitoring program, and the HDAR commercial catch reporting system (for troll and handline). See notes to Tables 1 and 3 for estimation procedures. Estimates are rounded to the nearest 100,000 pounds. The numbers may not add up due to rounding.

Interpretation: Longline landings of non-tuna PPMUS increased 20% while troll and handline landings decreased by 29%. The drop in mahimahi landings probably accounts for most of the decrease in troll and handline landings

Figure 2b. Hawaii tuna landings by gear type.

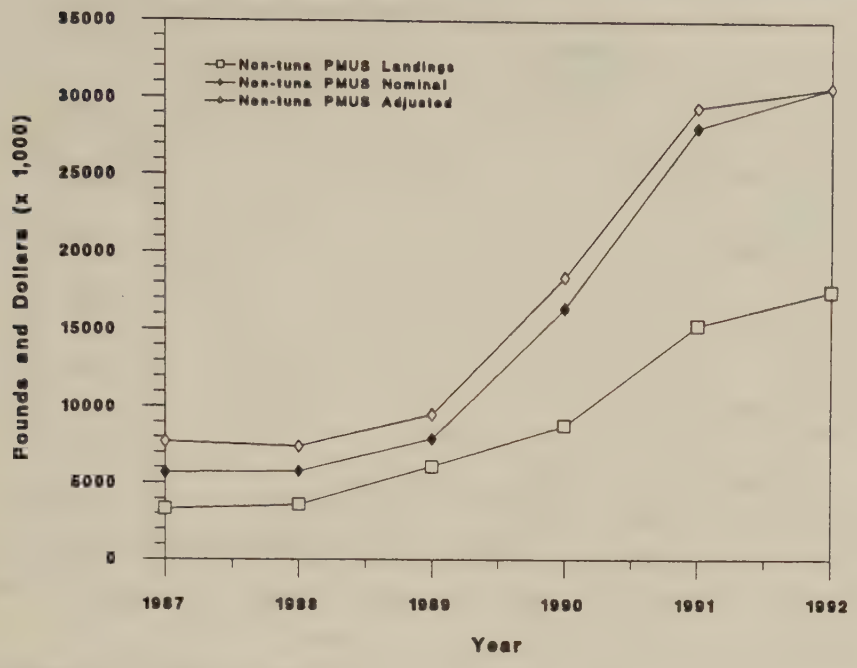


Year	Pounds Landed (x 1,000)		
	Longline	Pole & Line	Troll & Handline
1987	2,700	3,600	3,900
1988	4,700	4,300	2,700
1989	5,900	2,800	2,300
1990	5,600	1,000	2,500
1991	5,900	2,200	2,900
1992	4,900	1,500	2,900
Average	5,000	2,600	2,900

Source and Calculation: Landings data are collected by the NMFS and HDAR shoreside monitoring program, and the HDAR commercial catch reporting system (for troll and handline). See notes to Tables 1 and 3 for estimation procedures. Estimates are rounded to the nearest 100,000 pounds. The numbers may not add up due to rounding.

Interpretation: Longline landings of tuna were lower than in 1989-91, pole-and-line decreased by 32%, and troll and handline were about the same as 1991.

Figure 3. Hawaii non-tuna PPMUS landings and revenue.

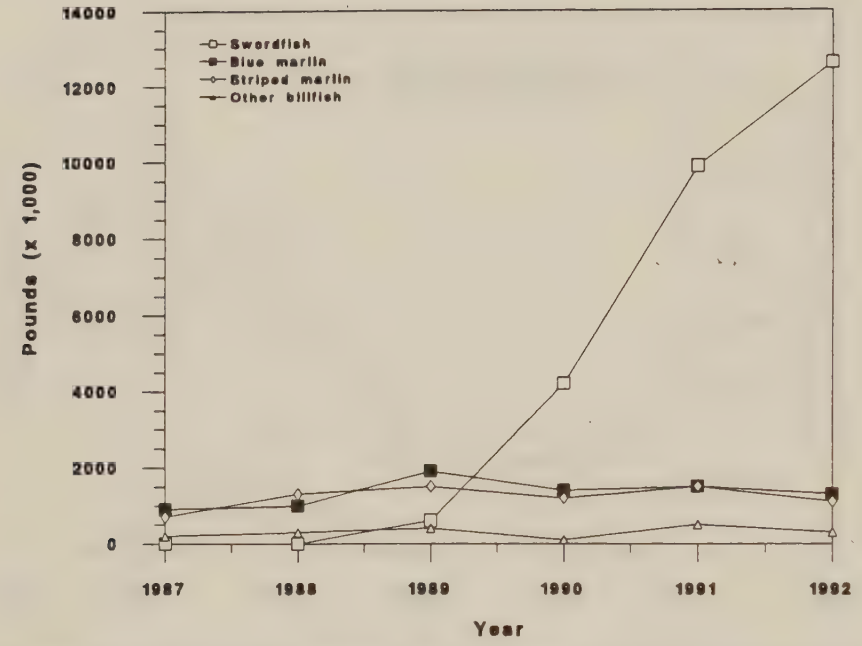


Year	Pounds (x 1,000)	Revenue (x $1,000)	
		Nominal	Adjusted
1987	3,300	5,700	7,700
1988	3,600	5,800	7,400
1989	6,100	7,900	9,500
1990	8,800	16,400	18,400
1991	15,300	28,100	29,400
1992	17,500	30,700	30,700
Average	9,100	15,800	17,200

Source and Calculation: Landings data are collected by the NMFS and HDAR shoreside monitoring program, and the HDAR commercial catch reporting system (for troll and handline). See notes to Tables 1 and 3 for estimation procedures. Estimates are rounded to the nearest 100,000 pounds. The numbers may not add up due to rounding.

Interpretation: Total non-tuna PPMUS landings increased slightly, as did nominal revenue and adjusted revenue. All 1992 figures were well above 1987-92 averages.

Figure 4. Species composition of Hawaii billfish landings.

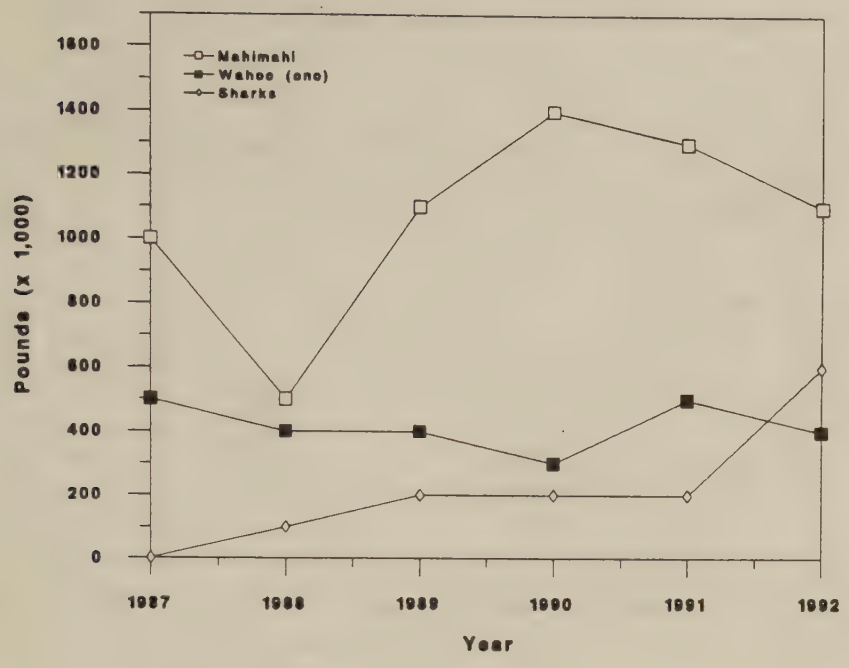


Year	Pounds Landed (x 1,000)			
	Swordfish	Blue marlin	Striped marlin	Other billfish
1987	0	900	700	200
1988	0	1,000	1,300	300
1989	600	1,900	1,500	400
1990	4,200	1,400	1,200	100
1991	9,900	1,500	1,500	500
1992	12,600	1,300	1,100	300
Average	4,600	1,300	1,200	300

Source and Calculation: Landings data are collected by the NMFS and HDAR shoreside monitoring program, and the HDAR commercial catch reporting system (for troll and handline). See notes to Tables 1 and 3 for estimation procedures. Estimates are rounded to the nearest 100,000 pounds. The numbers may not add up due to rounding.

Interpretation: Swordfish landings increased 27% from 1991, compared to the 136% increase from 1990 to 1991. Blue marlin landings remained at about the same level as 1990-91. Striped marlin landings decreased 27% and was slightly below the 1987-92 average. Other billfish landings returned to the 1987-92 average.

Figure 5. Hawaii landings -- mahimahi, wahoo, and sharks.

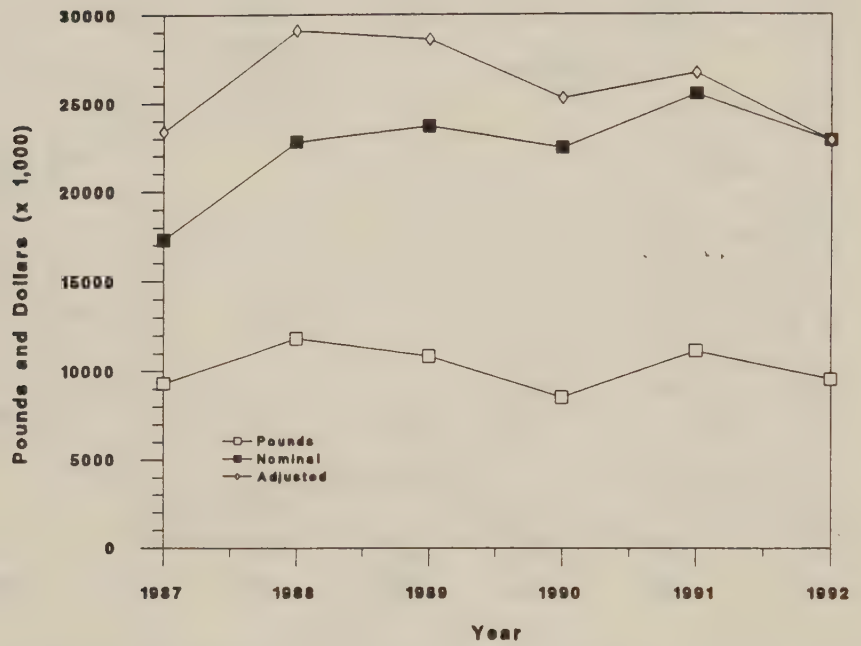


Year	Pounds (x 1,000)		
	Mahimahi	Wahoo	Sharks
1987	1,000	500	0
1988	500	400	100
1989	1,100	400	200
1990	1,400	300	200
1991	1,300	500	200
1992	1,100	400	600
Average	1,100	400	200

Source and Calculation: Landings data are collected by the NMFS and HDAR shoreside monitoring program, and the HDAR commercial catch reporting system (for troll and handline). See notes to Tables 1 and 3 for estimation procedures. Estimates are rounded to the nearest 100,000 pounds. The numbers may not add up due to rounding.

Interpretation: Mahimahi landings decreased 15% from 1991, and matched the 1987-92 average. Wahoo landings were about the same as 1991, while shark landings increased substantially above the average. The increased shark landings may be due to improved reporting as a result of the logbook longline program.

Figure 6. Hawaii tuna landings and revenue.

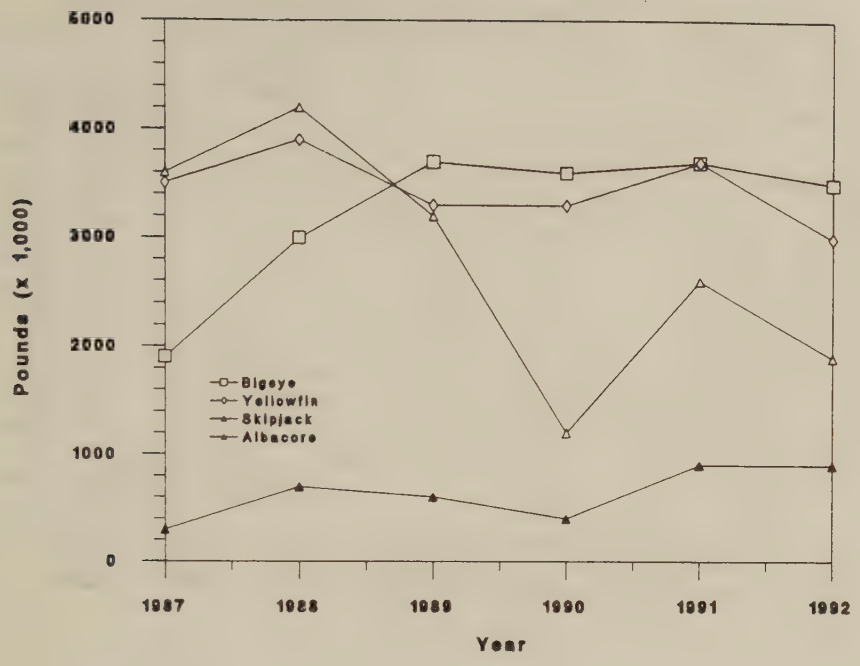


Year	Pounds (x 1,000)	Revenue (x $1,000)	
		Nominal	Adjusted
1987	9,300	17,300	23,400
1988	11,800	22,800	29,100
1989	10,800	23,700	28,600
1990	8,500	22,500	25,300
1991	11,100	25,500	26,700
1992	9,500	22,900	22,900
Average	10,200	22,400	26,000

Source and Calculation: Landings data are collected by the NMFS and HDAR shoreside monitoring program, and the HDAR commercial catch reporting system (for troll and handline). See notes to Tables 1 and 3 for estimation procedures. Estimates are rounded to the nearest 100,000 pounds. The numbers may not add up due to rounding.

Interpretation: Total tuna landings decreased 14%, and was below the 1987-92 average. Nominal and adjusted revenue also decreased slightly from the previous year. Lower skipjack and yellowfin tuna landings accounted for 88% of the decrease (see Figure 7).

Figure 7. Species composition of Hawaii tuna landings.

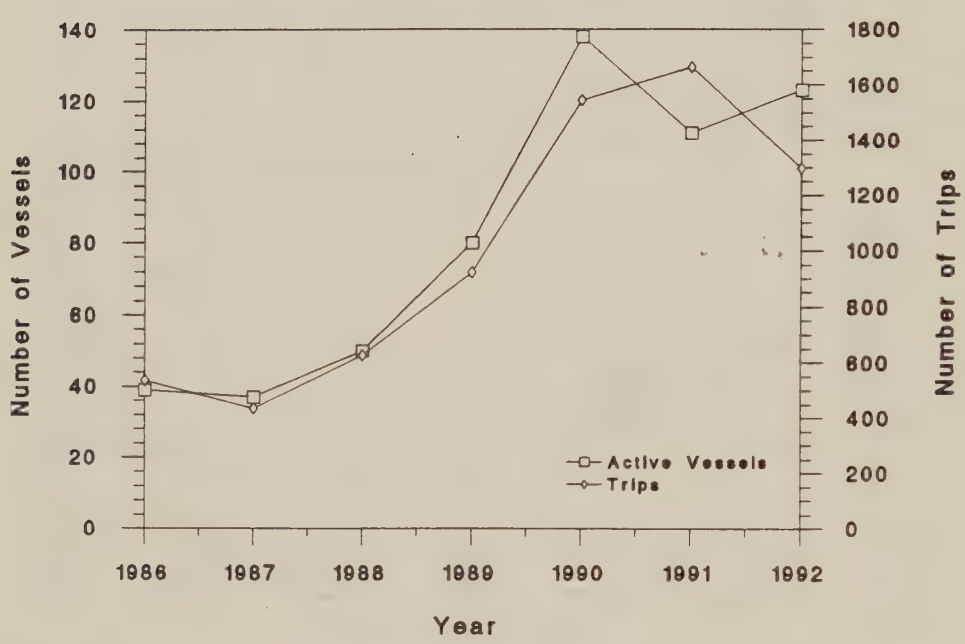


Year	Pounds Landed (x 1,000)			
	Bigeye	Yellowfin	Skipjack	Albacore
1987	1,900	3,500	3,600	300
1988	3,000	3,900	4,200	700
1989	3,700	3,300	3,200	600
1990	3,600	3,300	1,200	400
1991	3,700	3,700	2,600	900
1992	3,500	3,000	1,900	900
Average	3,200	3,400	2,800	600

Source and Calculation: Landings data are collected by the NMFS and HDAR shoreside monitoring program, and the HDAR commercial catch reporting system (for troll and handline). See notes to Tables 1 and 3 for estimation procedures. Estimates are rounded to the nearest 100,000 pounds. The numbers may not add up due to rounding.

Interpretation: All species except albacore showed decreases from 1991. Bigeye and albacore landings were higher than the 1987-92 average, while yellowfin and skipjack were below average.

Figure 8. Hawaii longline vessel activity.

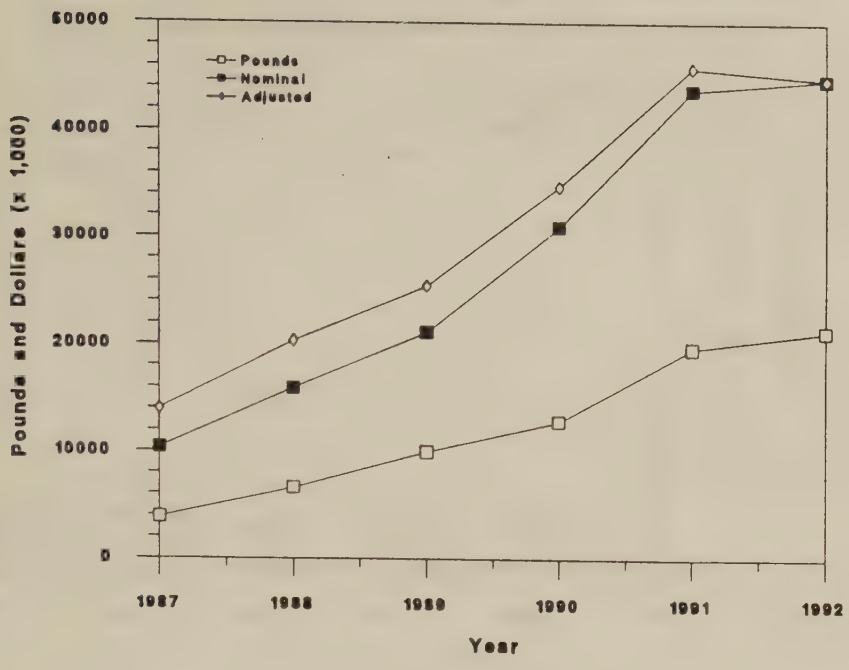


Year	Active Vessels	Trips
1986	39	537
1987	37	435
1988	50	627
1989	80	923
1990	138	1,546
1991	111	1,665
1992	123	1,299

Source and Calculation: Landings data are collected by the NMFS and HDAR shoreside monitoring program and NMFS longline logbook program. See notes to Tables 1 and 3 for estimation procedures. Estimates are rounded to the nearest 100,000 pounds. The numbers may not add up due to rounding. Active vessels are defined as those making at least one longline landing in 1992.

Interpretation: The number of active longline vessels increased from 1991, but the number of trips decreased by 22%. The decrease in number of trips could be due to increased targeting of swordfish by the fleet and hence, longer-ranging but fewer trips.

Figure 9. Hawaii longline landings and revenue.

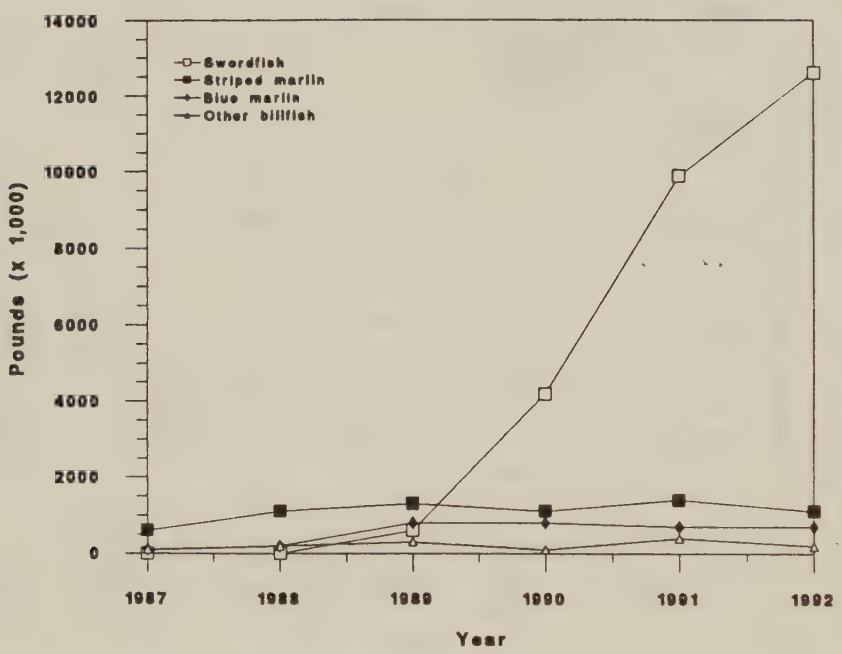


Year	Pounds (x 1,000)	Revenue (x $1,000)	
		Nominal	Adjusted
1987	3,800	10,300	13,900
1988	6,600	15,900	20,300
1989	9,900	21,100	25,400
1990	12,800	30,900	34,700
1991	19,600	43,700	45,800
1992	21,200	44,700	44,700
Average	12,100	27,800	30,800

Source and Calculation: Landings data are collected by the NMFS and HDAR shoreside monitoring program and NMFS longline logbook program. See notes to Tables 1 and 3 for estimation procedures. Estimates are rounded to the nearest 100,000 pounds. The numbers may not add up due to rounding.

Interpretation: Longline landings increased 8% from 1991. Although nominal revenue increased slightly, adjusted revenue decreased slightly.

Figure 10. Hawaii longline landings -- billfish.

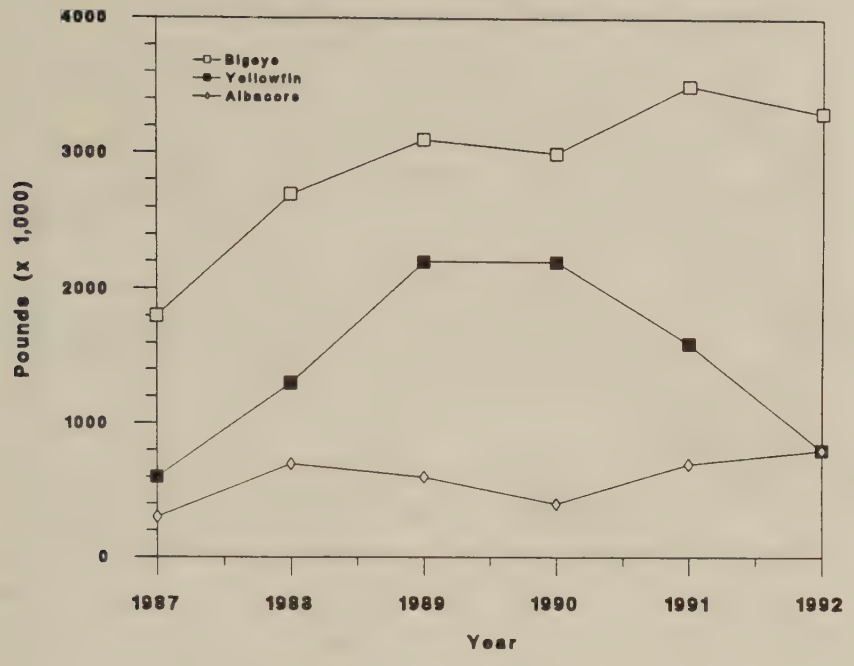


Year	Pounds Landed (x 1,000)			
	Swordfish	Striped marlin	Blue marlin	Other billfish
1987	0	600	100	100
1988	0	1,100	200	200
1989	600	1,300	800	300
1990	4,200	1,100	800	100
1991	9,900	1,400	700	400
1992	12,600	1,100	700	200
Average	4,600	1,100	600	200

Source and Calculation: Landings data are collected by the NMFS and HDAR shoreside monitoring program and NMFS longline logbook program. See notes to Tables 1 and 3 for estimation procedures. Estimates are rounded to the nearest 100,000 pounds. The numbers may not add up due to rounding.

Interpretation: Landings of swordfish increased 27% from 1991, and striped marlin landings decreased 21%. Blue marlin and other billfish landings showed little change.

Figure 11. Hawaii longline landings -- tunas.

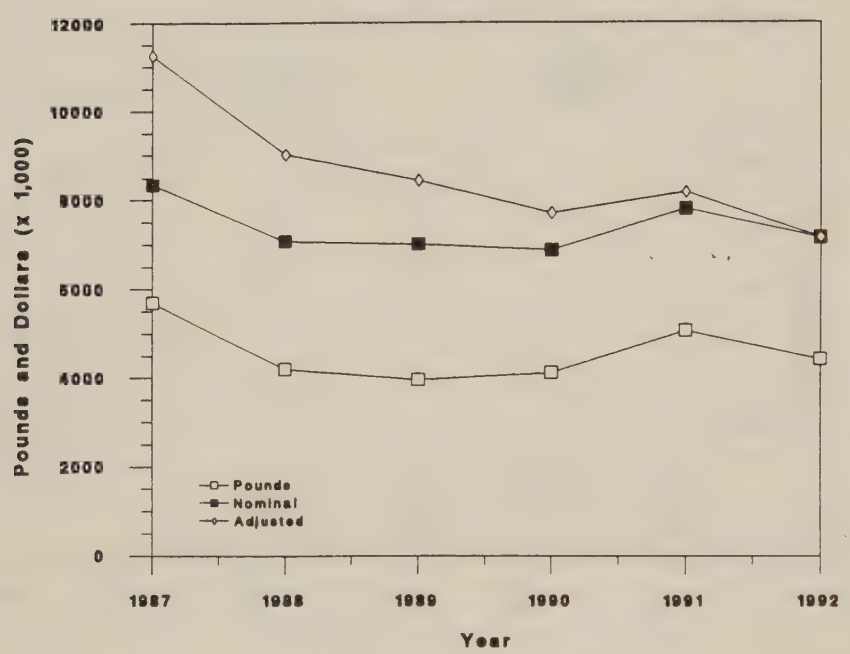


Year	Pounds Landed (x 1,000)		
	Bigeye	Yellowfin	Albacore
1987	1,800	600	300
1988	2,700	1,300	700
1989	3,100	2,200	600
1990	3,000	2,200	400
1991	3,500	1,600	700
1992	3,300	800	800
Average	2,900	1,400	600

Source and Calculation: Landings data are collected by the NMFS and HDAR shoreside monitoring program and NMFS longline logbook program. See notes to Tables 1 and 3 for estimation procedures. Estimates are rounded to the nearest 100,000 pounds. The numbers may not add up due to rounding.

Interpretation: While longline landings of albacore showed a slight increase from 1991, landings of bigeye tuna decreased slightly (-6%) and yellowfin tuna decreased substantially (-50%).

Figure 12. Hawaii troll and handline landings and revenue.

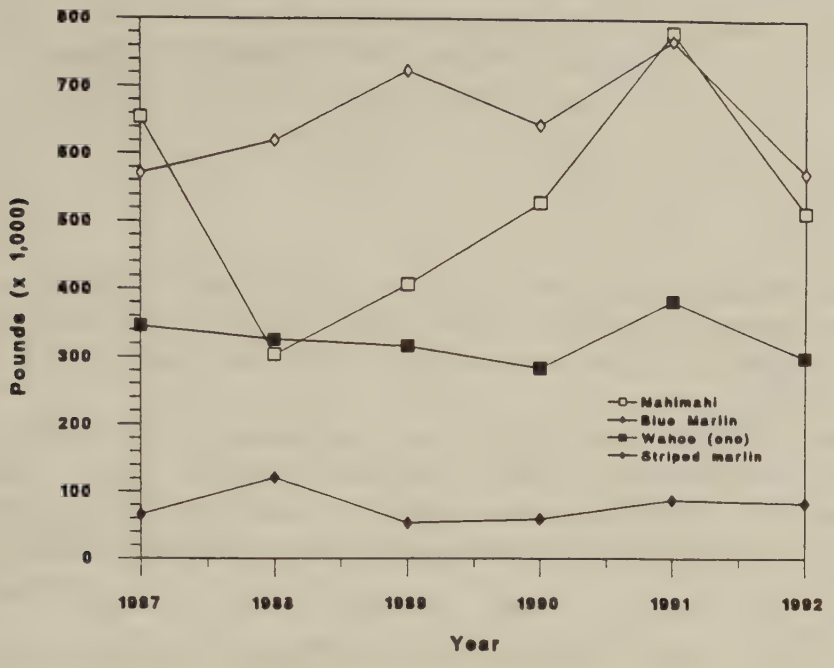


Year	Pounds (x 1,000)	Revenues (x $1,000)	
		Nominal	Adjusted
1987	5,700	8,300	11,300
1988	4,200	7,100	9,000
1989	4,000	7,000	8,400
1990	4,100	6,900	7,700
1991	5,000	7,800	8,200
1992	4,400	7,100	7,100
Average	4,600	7,400	8,600

Source and Calculation: Landings data are collected by the HDAR commercial catch reporting system. See notes to Tables 1 and 3 for estimation procedures. Estimates are rounded to the nearest 100,000 pounds. The numbers may not add up due to rounding.

Interpretation: Troll and handline landings (-12%) and nominal revenue (-9%) decreased from 1991, but returned to 1990 levels. Adjusted revenue decreased by 13% and was substantially lower than the 1987-1992 average.

Figure 13. Hawaii troll and handline landings -- non-tuna PPMUS.

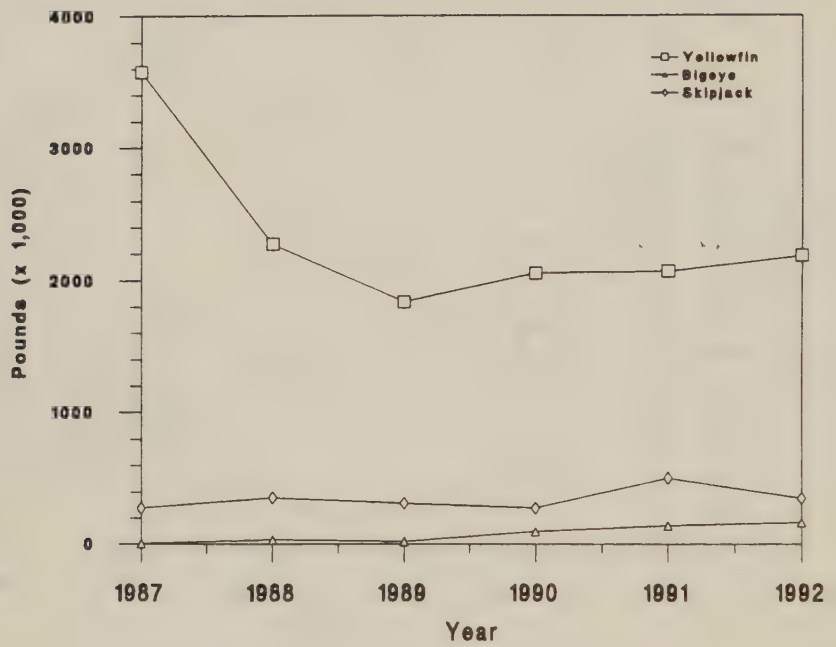


Year	Pounds Landed (x 1,000)			
	Mahimahi	Blue marlin	Wahoo (ono)	Striped marlin
1987	700	600	300	100
1988	300	600	300	100
1989	400	700	300	100
1990	500	600	300	100
1991	800	800	400	100
1992	500	600	300	100
Average	500	600	300	100

Source and Calculation: Landings data are collected by the HDAR commercial catch reporting system. See notes to Tables 1 and 3 for estimation procedures. Estimates are rounded to the nearest 100,000 pounds. The numbers may not add up due to rounding.

Interpretation: While the troll and handline landings of blue marlin, wahoo, and striped marlin showed slight change, the landings of mahimahi decreased substantially (-38%). The lower landings of mahimahi in all gear types contributed largely to the lower total landings of all PPMUS in 1992.

Figure 14. Hawaii troll and handline landings -- tunas.



Year	Pounds Landed (x 1,000)		
	Yellowfin	Bigeye	Skipjack
1987	3,600	6	300
1988	2,300	31	400
1989	1,800	19	300
1990	2,100	97	300
1991	2,100	142	500
1992	2,200	164	300
Average	2,400	76	400

Source and Calculation: Landings data are collected by the HDAR commercial catch reporting system. See notes to Tables 1 and 3 for estimation procedures. Estimates are rounded to the nearest 100,000 pounds (except bigeye tuna). The numbers may not add up due to rounding.

Interpretation: In 1992, troll and handline landings of yellowfin tuna were slightly higher (5%) than in 1991. Bigeye tuna landings were higher (15%), while skipjack landings decreased slightly (-4%).

Appendix 4

State of Hawaii - Part B

(non-longline gear only)

Introduction

The staff of the Hawaii Department of Land and Natural Resources, Division of Aquatic Resources (DAR) produced this report on the non-longline Hawaii pelagic fisheries. Current calendar year (1992) data are presented in this report.

The DAR summaries are produced from the State's mandatory commercial catch reporting system. Every fisherman who sells marine life is required to have a Commercial Marine License and, unless specifically exempted[1], is required to submit a catch report monthly to the DAR, where it is received and processed by the Statistics Unit.

Commercial Marine Licenses are issued on a fiscal year basis, so the following data are from fiscal year 1992 (July 1991 to June 1992). A total of 3,800 fishermen were licensed, of which 2,700 were required to report. The DAR received 25,038 reports, or 91.8% of a total of 27,286 expected, as of March 1993. The DAR asked fishermen to identify their primary fishing gear/method on the Commercial Marine License at the time of licensing. This did not preclude fishermen from using other gears or methods, but indicates what they considered to be their usual method. According to the licenses, 1,541 were trollers, 762 used longline, and 156 were tuna handliners (ika-shibi or palu-ahi), for a total of 2,459 pelagic fishermen. Of these, 1,413 trollers, 157 longliners, and 142 handliners were required to submit catch reports to DAR, for a total of 1,712.

Some of the statistics may change depending upon information received from delinquent 1992 catch reports.

As in the 1991 Pelagic Annual Report, these summaries represent recent changes in the DAR Commercial Fisheries Statistical Charts. Fishermen must report the area where they made their catches using statistical charts provided by the DAR. A new set of charts went into effect in July 1990, which provided new statistical area codes for areas that were not covered by old charts. This accommodated fishers who were fishing well beyond the boundaries of the old charts. The data presented here include data from areas covered by the new 1990 charts, covering the entire Hawaiian Archipelago.

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[1] Only one person per vessel is required to submit a catch report. This person is usually the captain or a representative of the owner. Crew members are generally not required to submit catch reports.

The DAR does not collect recreational fish catch data as no authority or mechanism exists to accomplish this. The DAR contracted a one-time survey of small-boat commercial and recreational fishers in 1990-91 at ports around the island of Oahu, at the request of the Western Pacific Regional Fishery Management Council and funded through the NMFS. The data from the one-year survey were analyzed by the Honolulu Laboratory. A preliminary report is available from the Honolulu Laboratory or from the Council. The lack of long-term recreational data and lack of data on unlicensed commercial fishers remain serious problems.

Summary

The total landings of pelagic species increased slightly in 1992, but inflation-adjusted revenues declined slightly. Catch rates for major pelagic species caught by trollers, baitboats, and handliners decreased in 1992, except for troll yellowfin and handline bigeye tuna, which increased.

The longline fishery changed from being predominantly a tuna fishery to being predominantly a swordfish fishery in 1991, and this continued in 1992. In addition, landings of bigeye tuna were higher than yellowfin tuna. It is also suspected that more sharks are being caught than being reported. "Finning" of sharks may also be taking place.

The bigeye tuna catch rate in the tuna handline fisheries reached a new high in 1992. This is probably due to a larger contribution by fishermen fishing offshore on seamounts and/or weather buoys.

Recommendations

1. The Council should continue efforts to collect data from recreational fisheries including extending the small-boat creel survey to cover the entire state.

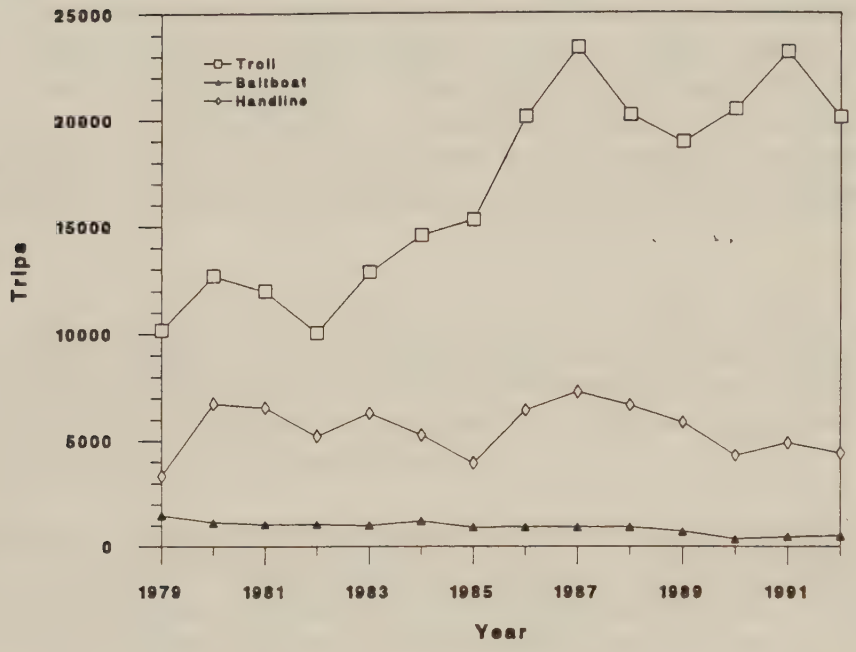
2. The Council should commission a study of the issue of trollers and handliners catching small tunas. The study should determine the effects of catching immature yellowfin and bigeye tuna on local fish populations and markets.

3. The Council should support a tagging program on juvenile tuna caught around offshore seamounts. This study would help to characterize potential interactions among various pelagic fisheries. A proposal is currently being developed for Year 2 of the SOEST Pelagic Fisheries Research Program.

4. The Council should commission an independent survey of all Hawaii pelagic fisheries to estimate the coverage and accuracy of existing data sets.

5. The State and NMFS should examine the effects of the seasonal modifications to the longline closed area around the Main Hawaiian Islands.

Figure 1. Hawaii Pelagic Trips by Gear Type



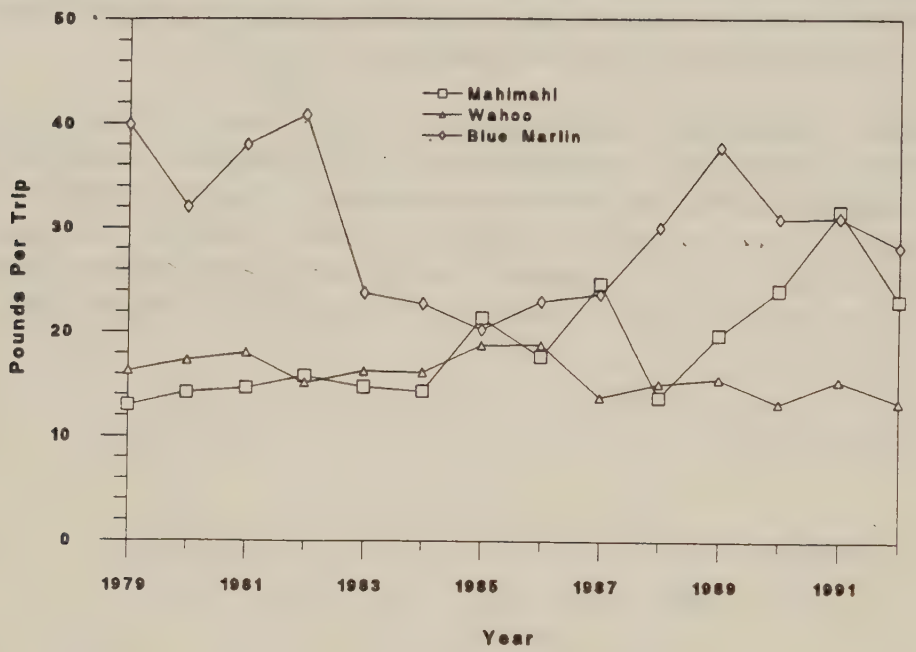
Year	Number of Trips		
	Troll	Baitboat	Handline
1979	10,185	1,495	3,346
1980	12,692	1,149	6,746
1981	11,975	1,059	6,562
1982	10,039	1,067	5,219
1983	12,842	1,014	6,275
1984	14,556	1,232	5,248
1985	15,291	924	3,929
1986	20,139	941	6,412
1987	23,391	938	7,263
1988	20,202	941	6,647
1989	18,924	723	5,834
1990	20,468	378	4,261
1991	23,184	463	4,861
1992	20,109	510	4,374

Source and Calculation: Division of Aquatic Resources's Commercial Catch Reports for calendar years. Each day fished for a pelagic species by a fisher is one trip, that is, daily trips are assumed. All handline gear trips were combined

into the HL trip total. Total handline trips may be inaccurate for recent years due to multi-day trips taken by fishermen fishing offshore seamounts or weather buoys. Unsuccessful (no-catch) trips are not included; such data generally have not been reported by fishers and were not processed prior to 1989.

Interpretation: Reported trolling trips have doubled since 1979, with a rapid increase in the mid-1980s. Baitboat trips have decreased by about 70%, beginning about the time the Honolulu tuna cannery closed in 1984. Combined handline trips show no particular trend, with peaks in 1980, 1983, and 1987, but have decreased from 1991. Longline trips are not shown because known deficiencies in reporting may underestimate actual trips in recent years.

Figure 2. Trolling Catch Per Trip -- Mahimahi, Wahoo and Blue Marlin.

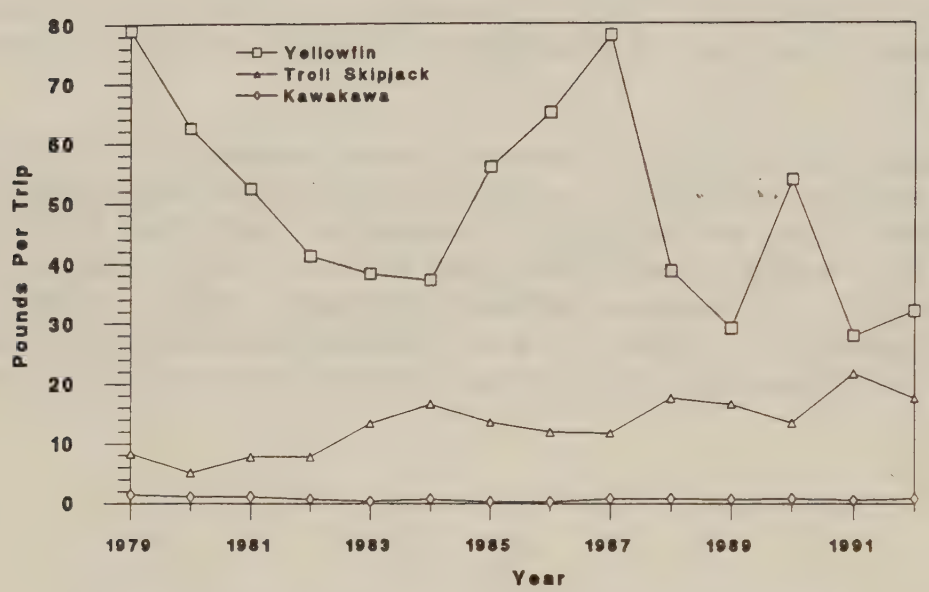


Year	Pounds Caught per Trolling Trip		
	Mahimahi	Wahoo	Blue Marlin
1979	13.0	16.3	39.9
1980	14.2	17.3	32.0
1981	14.6	18.0	37.9
1982	15.8	15.1	40.8
1983	14.7	16.3	23.8
1984	14.3	16.1	22.7
1985	21.3	18.8	20.3
1986	17.7	18.8	22.9
1987	24.7	13.8	23.7
1988	13.8	15.1	30.1
1989	19.8	15.6	37.7
1990	24.0	13.2	30.9
1991	31.5	15.4	32.5
1992	23.4	13.7	28.0

Source and Calculation: Division of Aquatic Resources's Commercial Catch Reports for calendar years. Estimated catch per trip (CPT) was calculated by dividing the annual troll landings of each major species by the annual number of troll trips that caught any PPMUS. Unsuccessful (no-catch) trips are not included; such data generally have not been reported by fishers and were not processed prior to 1989.

Interpretation: Blue marlin CPT showed a broad depression from 1983 to 1987, but rose rapidly in 1988-89 to pre-1983 levels. The CPT dropped in 1990-92, but still remained higher than in 1983-87. Except for a slight peak in 1980-1981, wahoo CPT remained nearly constant over the entire period. Mahimahi CPT peaked in 1991, but decreased to about 1990 level in 1992. Longline catch per trip (CPT) data are not shown in this or in following graphs due to large changes in fishing effort (gear quantity, technology, and efficiency) per trip in recent years.

Figure 3. Trolling Catch Per Trip -- Yellowfin, Skipjack and Kawakawa.

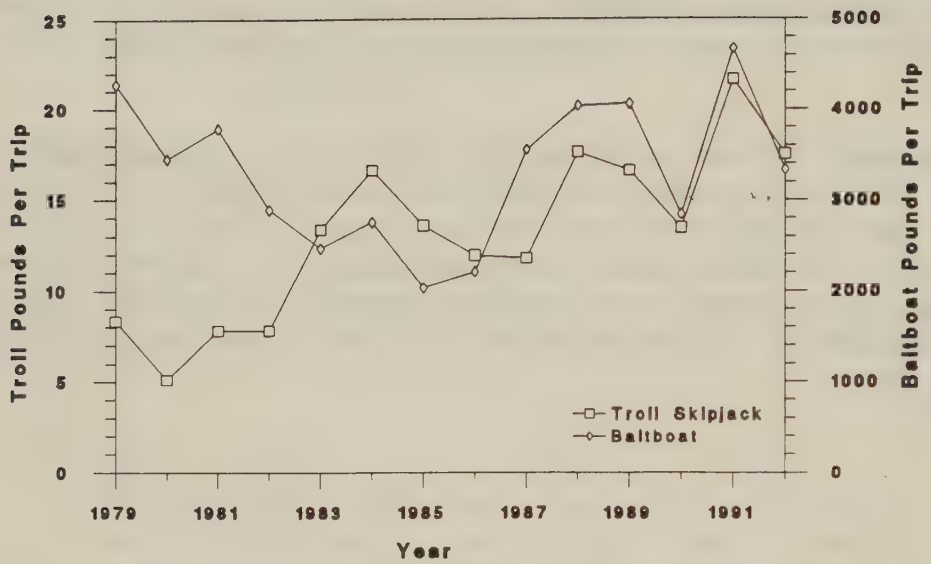


Year	Pounds Caught per Trolling Trip		
	Yellowfin	Skipjack	Kawakawa
1979	79.0	8.3	1.4
1980	62.5	5.1	1.0
1981	52.5	7.8	1.1
1982	41.3	7.8	0.7
1983	38.3	13.4	0.3
1984	37.2	16.6	0.8
1985	55.9	13.6	0.3
1986	65.1	11.9	0.3
1987	78.1	11.8	0.8
1988	38.7	17.6	0.8
1989	29.2	16.6	0.7
1990	53.9	13.4	0.8
1991	28.2	21.7	0.5
1992	32.3	17.2	0.8

Source and Calculation: Division of Aquatic Resources's Commercial Catch Reports for calendar years. Estimated catch per trip (CPT) was calculated by dividing the annual troll landings of each major species by the annual number of troll trips that caught any PPMUS. Unsuccessful (no-catch) trips are not included; such data generally have not been reported by fishers and were not processed prior to 1989.

Interpretation: Yellowfin CPT has fluctuated widely, decreasing sharply from 1979 to 1984, rising steeply to 1987, and decreasing to lower than 1984's low in 1989. The 1992 CPT rose from the record low CPT in 1991 but still remains below the long-term average of 49.4 pounds per trip. Skipjack CPT showed a rising trend for the entire period, while kawakawa CPT declined about 50%. Interestingly, the low points in yellowfin CPT correspond roughly with peaks in skipjack CPT.

Figure 4. Catch Per Trip for Skipjack, Troll v. Baitboat.



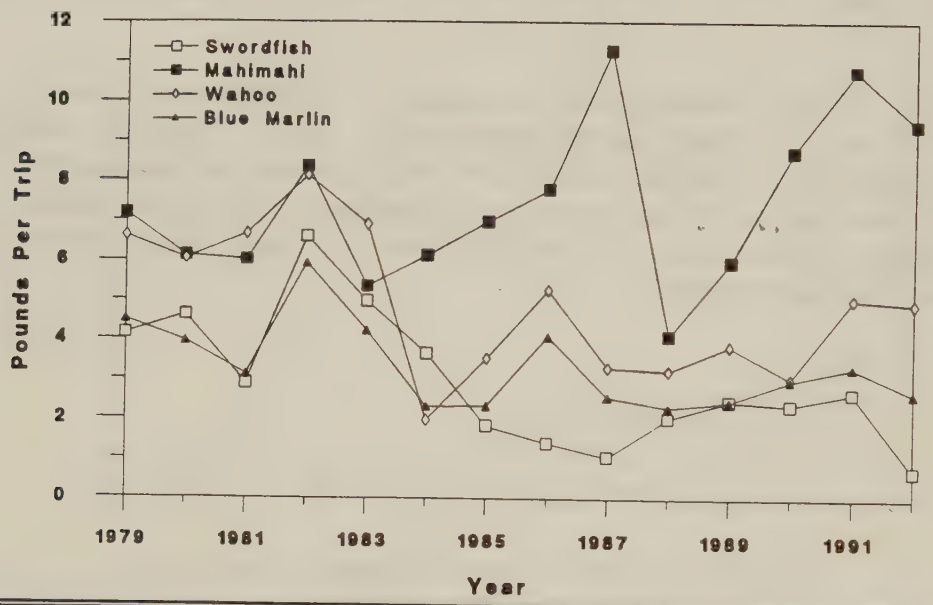
Year	Pounds Skipjack Caught per Trip	
	Troll	Baitboat
1979	8.3	4278
1980	5.1	3447
1981	7.8	3786
1982	7.8	2892
1983	13.4	2468
1984	16.6	2748
1985	13.6	2031
1986	11.9	2206
1987	11.8	3548
1988	17.6	4036
1989	16.6	4061
1990	13.4	2840
1991	21.7	4722
1992	17.2	3297

Source and Calculation: Division of Aquatic Resources Commercial Catch Reports for calendar years. Estimated catch per trip (CPT) was calculated by dividing the

annual troll or baitboat landings of each major species by the annual number of troll or baitboat trips that caught any PPMUS. Unsuccessful (no-catch) trips are not included; such data generally have not been reported by fishers and were not processed prior to 1989. Troll skipjack data do not include skipjack used as live bait.

Interpretation: There was a broad depression in baitboat catch per trip during the early 1980s, a dip in 1990, but a record high in 1991. Troll CPT also reached a record high in 1991. The similarity in trends between troll and baitboat CPT from 1986 on may be due to the dramatically reduced baitboat fleet working mainly around Oahu, where most of the trolling fleet is located. Both dropped in 1992, continuing the association.

Figure 5. Combined Handline Catch Per Trip -- Swordfish, Mahimahi, Wahoo and Blue Marlin.

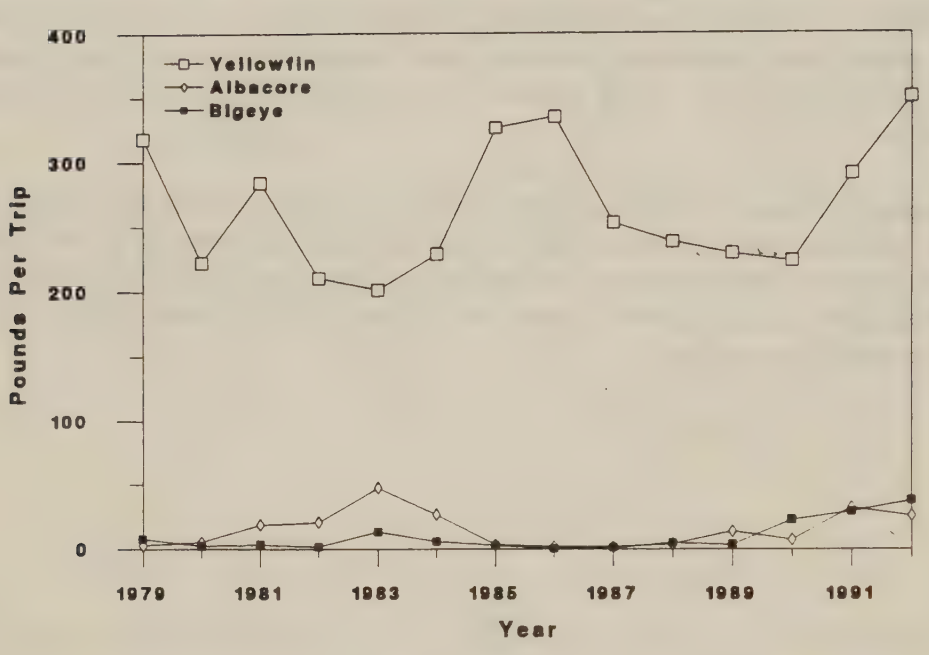


Year	Combined Handline Catch per Trip (lb)			
	Swordfish	Mahimahi	Wahoo	Blue Marlin
1979	4.1	7.2	6.6	4.5
1980	4.6	6.1	6.0	4.0
1981	2.9	6.0	6.7	3.1
1982	6.6	8.4	8.1	5.9
1983	5.0	5.3	6.9	4.2
1984	3.6	6.1	2.0	2.3
1985	1.8	7.0	3.5	2.3
1986	1.4	7.8	5.2	4.1
1987	1.1	11.3	3.3	2.5
1988	2.0	4.1	3.2	2.3
1989	2.4	6.0	3.8	2.4
1990	2.3	8.7	3.0	3.0
1991	2.7	10.2	5.3	3.4
1992	0.7	10.2	5.3	2.7

Source and Calculation: Division of Aquatic Resources's Commercial Catch Reports for calendar years. Estimated catch per trip (CPT) calculated by dividing the annual handline landings of each major species by the annual number of handline trips that caught any PPMUS. Unsuccessful (no-catch) trips are not included; such data generally have not been reported by fishers and were not processed prior to 1989. Only major non-tuna PMUS caught by handline are shown here.

Interpretation: Except for swordfish, the three major handline PPMUS show peaks in CPT in 1982 and in 1986 or 1987. Mahimahi CPT rises to a record peak in 1987, drops to a new low in 1988, then rises to a peak in 1991 almost matching 1987. The CPT for all species increased between 1989 and 1991, but dropped in 1992, especially swordfish.

Figure 6. Combined Handline Catch Per Trip -- Yellowfin, Albacore and Bigeye.



Year	Combined Handline Catch per Trip (lb)		
	Yellowfin	Albacore	Bigeye
1979	318.1	2.6	7.8
1980	222.4	5.0	2.3
1981	284.5	18.6	3.3
1982	210.5	20.5	1.6
1983	201.2	47.6	13.1
1984	228.6	26.7	5.6
1985	326.0	3.1	2.6
1986	334.9	1.8	0.4
1987	252.9	1.8	0.9
1988	238.4	3.7	4.9
1989	229.2	13.4	3.3
1990	223.2	7.0	22.7
1991	290.8	32.3	29.2
1992	350.2	25.8	37.5

Source and Calculation: Division of Aquatic Resources's Commercial Catch Reports for calendar years. Estimated catch per trip (CPT) calculated by dividing the annual handline landings of each major species by the annual number of handline trips that caught any PPMUS. Unsuccessful (no-catch) trips are not included; such data generally have not been reported by fishers and were not processed prior to 1989. Only major tuna species caught by handline are shown here. Bigeye catch per trip may have errors due to reporting of bigeye as "bluefin" tuna or as yellowfin. Due to the relative volume of landings, the resulting errors in the yellowfin statistics are probably small.

Interpretation: In 1992, yellowfin CPT dropped about the same time that CPTs for the PPMUS rose to a peak. From 1985-90, landings of albacore and bigeye tuna increased while yellowfin was depressed, and then in 1985-86 were low again when yellowfin peaked. By 1987, yellowfin CPT declined through 1990, and then increased in 1991. Bigeye and yellowfin tuna CPT rose to record highs in 1992, while albacore CPT decreased. The bigeye CPT may due to the contribution of handline fishermen fishing around weather buoys and offshore seamounts. Since handline trips may be inaccurate for recent years due to multi-day trips taken by fishermen fishing offshore seamounts or weather buoys, the catch rates for bigeye may be inaccurate. However, we feel that the trend is real.

Appendix 5

Commonwealth of the Northern Mariana Islands

Introduction

The Northern Mariana Islands pelagic fishery occurs primarily surrounding the islands of Saipan, Tinian, Rota and Aguigan. This report, however, will be limited to the catches landed in Saipan, which is by far the largest market. The fishery will be characterized by data collected through the Commercial Purchase Data Base which records a portion of actual landings by recording all local fish sales to commercial establishments. This data collection system is dependent upon first-level purchasers of local fresh fish to accurately record all fish purchases by species categories on specially designed invoices. Staff from the Department of Natural Resources, Division of Fish and Wildlife (DFW) routinely collect and distribute invoice books to more than 50 participating local fish purchasers on Saipan. This same data collection system should be established for the Islands of Tinian and Rota by June 1993. Local fish purchasers include practically all fish markets, stores, restaurants, hotels and roadside vendors ("fish-mobiles").

Although this data collection system has been in operation since the mid-1970s, only data collected since 1983 are considered accurate enough to be comparable for most aspects of the fisheries. Accuracy of landings and invoice species identification is in need of improvement and conclusions reached in this report should be considered provisional. An analysis of monthly invoices by vendor of the Commercial Purchase Data Base will be necessary to identify and compensate for "missing data". In addition, some mechanism must be developed to distinguish kawakawa (*Euthynnus affinis*) landings from skipjack tuna (*Katsuwonus pelamis*) landings (i.e., the skipjack tuna data presented in this module contains a combination of kawakawa and skipjack tuna).

This database lacks information concerning fishing methodology, location and fishing effort, however, the Offshore Port Sampling Survey provides the additional data required for further analysis. The NMFS Honolulu Lab personnel are presently finalizing the computer programs necessary to estimate total landings and effort by method.

Summary

Trolling is the primary fishing method utilized in the pelagic fishery. A longlining venture, the only exception, was attempted by the US vessel *F/V SUN* which operated from March to October 1990. Fishing success was limited with less than 12 fishing trips completed. The catch revenue for the majority of trips did not

cover fuel and wage expenses. During 1991 two domestic longline vessels appeared in Saipan however, no fish were landed and the vessels left CNMI waters. One commercial fishing license was issued in 1992 involving pelagic fishing. Although not formally introduced to the local fishermen, ika-shibi fishing was experimentally tested in Northern Marianas waters during 1989 by a DFW consultant.

The pelagic fishing fleet, other than charter boats, consist primarily of vessels less than 24 feet in length which usually have a limited 20-mile travel radius from Saipan. In 1992, approximately 87% of all registered boats participated in some form of fishing activity. With respect to full time commercial fishing, 58 vessels were identified, whereas 108 vessels were classified as part-time commercial fishing. Subsistence fishing and/or recreational usage included 255 vessels. Fishing trips are generally restricted to daylight hours with all vessels returning before or soon after sunset.

In 1992, 28 vessels were registered with the Boating Safety Office as charter vessels, although only 13 vessels operate a full-time charter fishing operation. The remaining charter vessels are associated with the tourist industry. Each charter vessel generally retains its catch and sells at least half to local markets. The magnitude of charterboat sales are unknown, however at this time, it is believed that the local market can absorb the catch without impacting the commercial fishermen. A log book system was established in early 1993 for six charter fishing vessels (pelagic) which will obtain daily catch and effort data.

The primary target species for the pelagic fleet are skipjack tuna and mahimahi. During their seasonal runs, these fish usually inundate nearshore waters and provide easy targets for the local fishermen. In addition to the economic advantage of being nearshore and relative ease of capture, these two species are widely accepted by all ethnic groups and market demand usually remains high due to the recent population growth experienced on Saipan. All factors combined, skipjack tuna and mahimahi provide the local fishermen with an appealing and appropriate target species.

Recommendation

The Northern Mariana Islands report could be improved by the addition of standard fisheries data such as length-frequencies.

Table 1. CNMI 1992 commercial pelagic landings, revenues and price.

Species	Pounds	Revenue ($)	Ave. $/lb
Troll fish	29570	47190	1.60
Barracuda	138	145	1.05
Dolphin (Mahimahi)	21462	45363	2.11
Marlin	5345	6040	1.13
Sailfish	101	223	2.19
Rainbow Runner	991	1731	1.75
Wahoo	13738	30926	2.25
Miscellaneous Tunas	277	510	1.84
Skipjack Tuna	65982	117654	1.78
Dogtooth Tuna	4416	8076	1.83
Yellowfin Tuna	20672	48071	2.33
Total Tunas	**86931**	**166235**	**1.91**
Total Other PPMUS	**45061**	**90627**	**2.01**
Total Pelagics	**162691**	**305927**	**1.88**

Source and Calculation: Annual summaries for each species from the Commercial Purchase Data Base invoices.

Interpretation: In 1991 skipjack tuna, mahimahi and yellowfin tuna comprised 97% by weight of the "known species" pelagic landings. In contrast, in 1992 this species group comprised only 81% of the total "known species" pelagic landings. This decrease is directly related to the continued substantial decline of skipjack tuna landings, the mainstay of the CNMI pelagic fishery.

Historically, skipjack tuna has comprised over 73% by weight of the total pelagic landings each year from 1983 to 1990 (data taken from Figures 1 and 3). In 1989 a record high of 90% was observed. Per cent composition of skipjack tuna began declining in 1991 (61% of total landings) to a record low during 1992 (41% of total landings).

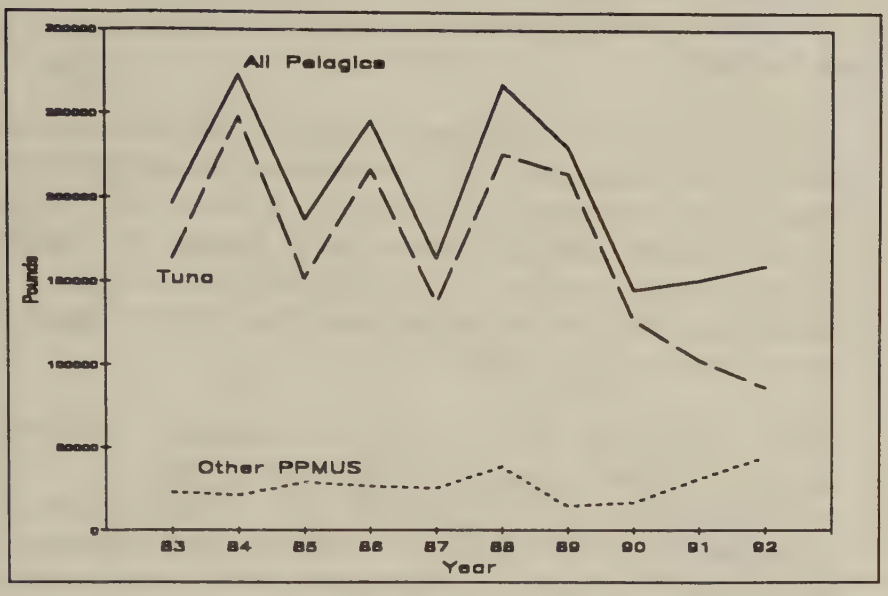
Even though a record low for skipjack tuna landings was reached in 1992, this species continued to lead weight and revenue statistics when compared with other landed species. Curiously, fishing effort increased during 1992, showing an increase in the number of pelagic fishing trips (Figure 5) and number of pelagic fisherman (boats) making pelagic landings (Figure 4). Although a slight increase in fishing vessels was noted for 1992, we believe a portion of the increase in pelagic fishing trips may actually be due to a greater increase in the data collection effort. Schools of skipjack tuna have historically been ubiquitous in nearshore waters, thus providing an opportunity to catch numerous fish with a minimum of travel time and fuel costs. Unlike Guam, skipjack tuna are readily consumed and even prized by the indigenous population.

Mahimahi and yellowfin tuna ranked second and third, respectively, in landings and each comprised approximately 16% of the "known species" pelagic landings. Schools of mahimahi, like skipjack tuna, are also easily caught in nearshore waters. Mahimahi, however, are highly seasonal, with peak landings in 1992 occurring during March and April.

Average prices of "known species" pelagic ranged from $1.05/lb for barracuda to $2.32/lb for yellowfin tuna. Combined yellowfin tuna and mahimahi revenues comprised 31% of the total pelagic fishery revenues, with each contributing approximately 15%. Yellowfin tuna commanded the best price as they are the species of choice with the restaurant industry. Skipjack tuna, the species with the greatest landings, received only $1.78/lb on average and generated 39% of the total pelagic fishery revenues for 1992.

Blue marlin brought the second lowest price. This species is taken primarily by charterboat fishermen, as well as other fishermen during the annual Saipan International Fishing Tournament. Although not regarded as an excellent eating fish, marlin sashimi is sold in local restaurants. In addition, the low ex-vessel price could be partly related to the manner which the fish is kept prior to sale and the bulky size. These large fish (relative to the other pelagic species caught) are generally not iced when caught and, therefore, are usually of lower quality at the time of sale. Fishermen usually wish to sell the whole fish to avoid cleaning and repackaging the fish into smaller units for sale to restaurants.

Figure 1. CNMI annual commercial landings -- all pelagics, tuna and PPMUS.



Year	Total Landings (lb)		
	All Pelagics	Tuna	Other PPMUS
1983	196788	163754	23081
1984	272909	248339	21223
1985	187378	151882	29105
1986	245967	217023	26800
1987	164055	137566	25467
1988	267619	225498	38368
1989	229427	214249	14650
1990	144862	127172	16893
1991	150915	103078	31300
1992	162691	86931	45061

Source and Calculation: All pelagic, Tuna and PPMUS landings are summed from the Commercial Purchase Data Base.

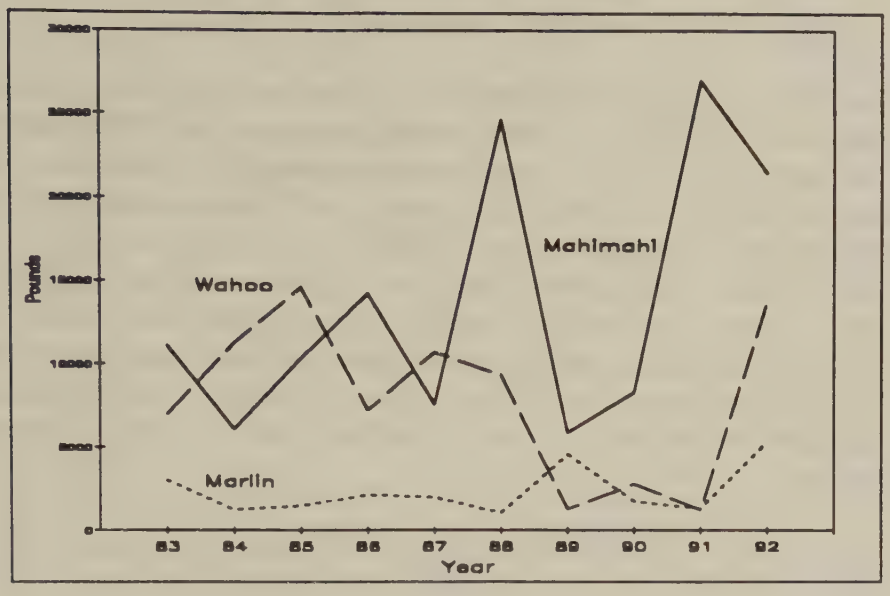
Interpretation: From 1983 to 1989 pelagic and tuna landings correlate well with an unexplained 2-year cyclic pattern. However, since 1991, tuna landings have been decreasing while all pelagic landings increased. This recent trend in pelagic, tuna and other PPMUS landings may be interpreted as significant, however, actual differences in the 1992 landings are not as great as what appears in Figure 1. The reasoning is as follows:

1) Tuna landings are highly correlated with the dominant tuna species caught, i.e., skipjack tuna. Yellowfin tuna landings have a negligible effect (with possible exception of 1991 and 1992 landings) when combined with skipjack tuna landings (Figure 3). Skipjack tuna landings have experienced substantial declines in landings for the last three years thus exhibiting an overall decline in tuna landings as shown accurately in Figure 1.

2) During 1991 and 1992, pelagic landings have increased slightly. Troll fish or "unknown pelagic species" comprises 17% of the total 1992 pelagic landings. If the tuna and other PPMUS landings could be discerned from the "unknown" troll fish data then an increase would be expected in these two categories, with a corresponding decrease in the all pelagic category. Therefore the obvious differences shown in Figure 1 would not be as prominent.

With respect to the other PPMUS category, yearly landings of mahimahi, wahoo and marlin (separately or in combination) appear to guide the landings trend. Since 1990, mahimahi landings were instrumental in determining a general increase in other PPMUS landings. In 1992, when mahimahi landings decreased, an overall increase in other PPMUS species landings was observed. The increase in wahoo and marlin landings more than compensated for the decrease in mahimahi landings; thus continuing a gradual increase in other PPMUS landings which began in 1990.

Figure 2. CNMI annual commercial landings -- mahimahi, wahoo, and marlins.



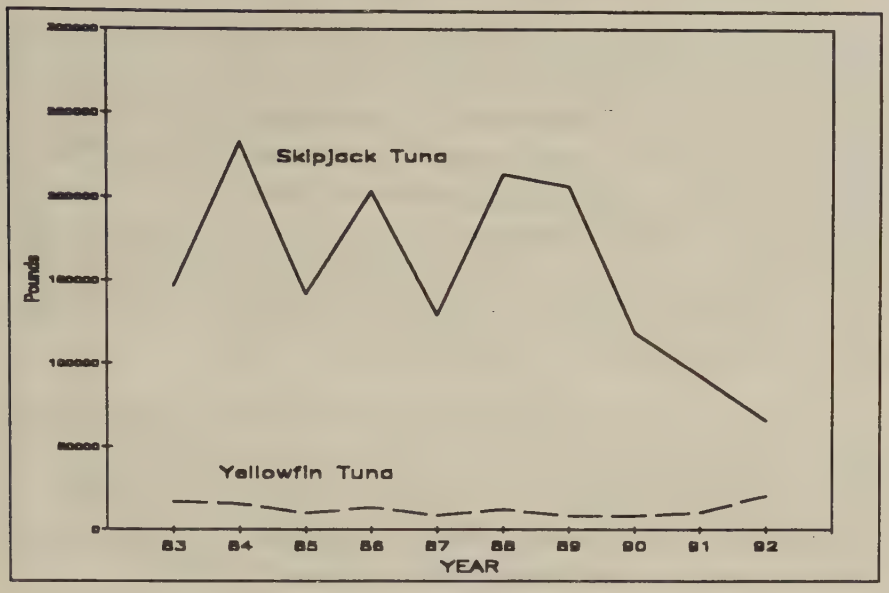
Year	Total Commercial Landings (lb)		
	Mahimahi	Wahoo	Blue Marlin
1983	11151	7008	3030
1984	6091	11270	1235
1985	10364	14601	1488
1986	14237	7250	2123
1987	7602	10723	1968
1988	24639	9358	1047
1989	5856	1257	4563
1990	8306	2770	1748
1991	27005	1217	1320
1992	21462	13738	5345

Source and Calculation: The annual commercial landings of the three major PPMUS species (mahimahi, wahoo and blue marlin) are summed directly from the Commercial Purchase Data Base.

Interpretation: Mahimahi landings decreased by 22% from the record high of 27,005 lb in 1991. Even with this decrease, the 1992 landings are the third highest since 1983. No explanation can be offered for the erratic cyclic pattern of mahimahi landings.

From 1983 to 1988, wahoo landings were somewhat consistent and exceeded 7,000 lb, however, in 1989, landings notably declined to 1257 lb and remained at these lowered levels until 1992. No explanation can be offered for the sudden 1989 decrease in landings. The 1992 wahoo landings approached the record high landings of 14,601 lb set in 1985. Due to the dearth of skipjack tuna in 1992, fishing effort was most likely refocused on other obtainable pelagic, such as wahoo, yellowfin tuna or mahimahi (when in season).
Even though marlin landings have historically remained at low levels (less than 3,000 lb), the 1992 landings were the highest on record. No explanation can be offered to explain this, however, due to the low landings, several large fish could make a difference.

Figure 3. CNMI annual commercial landings -- skipjack and yellowfin tuna.



Year	Total Commercial Landings (lb)	
	Skipjack tuna	Yellowfin tuna
1983	146729	17025
1984	232675	15664
1985	141910	9973
1986	203490	13533
1987	129203	8363
1988	213198	12300
1989	206162	8087
1990	118798	8374
1991	92642	10433
1992	65982	20672

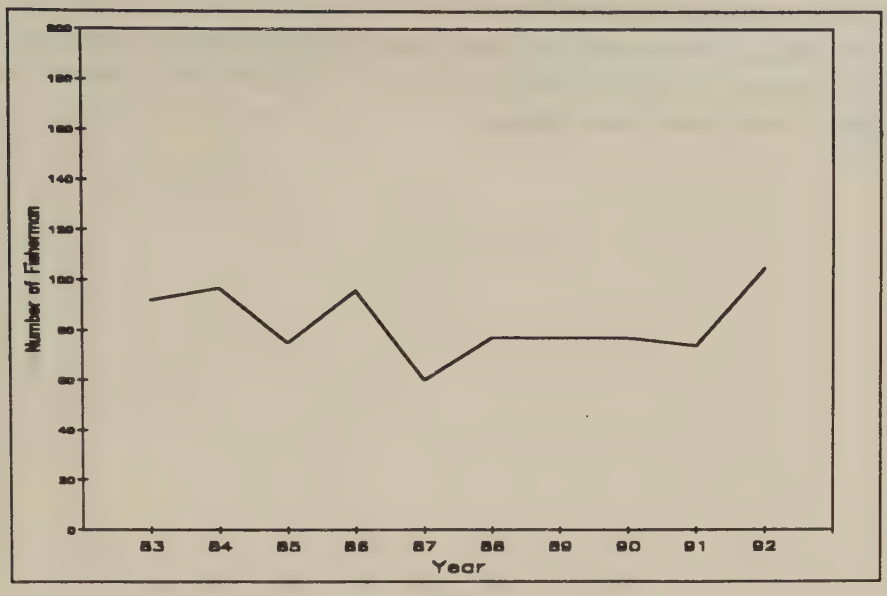
Source and Calculation: Landings are summed directly from the Commercial Purchase Data Base.

Interpretation: Historically, skipjack landings exhibited an alternating two year cycle from 1983 to 1988, however, landings have declined substantially each year from 1990. The 1992 landings are at the lowest recorded level.

Relative (species) fishing effort is believed to be somewhat consistent with previous years because of the importance of skipjack tuna in the local market, as well as its preference among fishermen. In actuality, the data indicate that fishing effort increased during 1992 with respect to number of boats making pelagic landings (Figure 4) and number of pelagic trips (Figure 5). If (landed) fish length was not significantly different between years, one could assume that skipjack tuna were not abundant in the waters surrounding a 20 mile radius of Saipan. The reason for the continuing decline in landings is unknown and should be investigated from a regional and biological perspective.

The 1992 yellowfin tuna landings experienced a record high of 20,492 lb. Due to the shortage of skipjack tuna, fishing effort may have been shifted toward yellowfin tuna, wahoo and mahimahi (when in season). In Saipan waters, yellowfin tuna are not often taken, and the average fish size tends to be smaller compared with yellowfin tuna from other geographic areas.

Figure 4. Number of CNMI fishermen (boats) making pelagic landings.

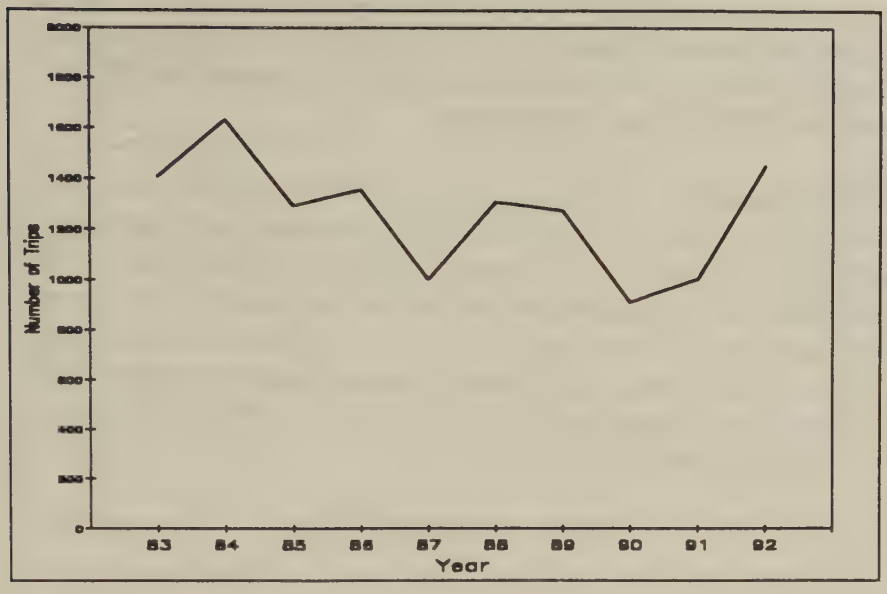


Year	No. fishermen landing any pelagic species
1983	92
1984	97
1985	75
1986	96
1987	60
1988	77
1989	77
1990	77
1991	74
1992	105

Source and Calculation: Each invoice from the Commercial Purchase Data Base records the fisherman's name from whom the fish were purchased. The number of fishermen who sold any pelagic species are calculated directly from the data.

Interpretation: The number of fishermen (boats) landing pelagic species remained constant from 1988 to 1990 while a decrease of three fishermen was noted in 1991. A record number of fishermen (boats) was recorded for 1992; a 39% increase from 1991. Some of the increase is attributable to new fishing boats brought to Saipan and partially to an increase of effort in collecting data used in the Commercial Purchase Data Base.

Figure 5. CNMI number of pelagic trips.



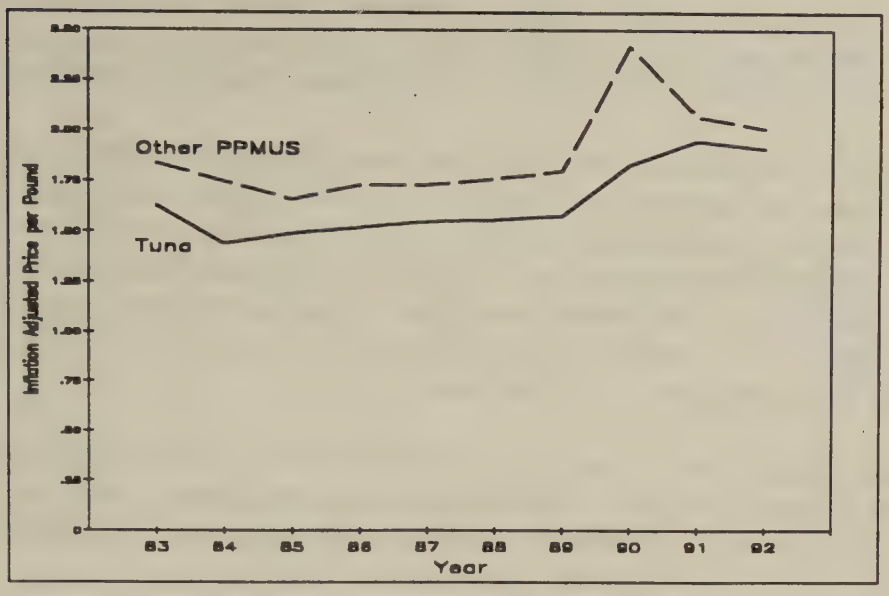
Year	No. pelagic trips
1983	1408
1984	1634
1985	1293
1986	1356
1987	999
1988	1306
1989	1272
1990	910
1991	1002
1992	1451

Source and Calculation: The total trips for all pelagic species are summed from the Commercial Purchase Data Base. Trips are calculated based on the assumptions that no fisherman makes more than one trip per day, and that all sales from a single trip are made on a single day.

Interpretation: The number of pelagic fishing trips in 1992 just exceeded the previous high record set in 1983. Since 1990 when a record low was established (910 trips), the number of pelagic fishing trips has been on an increase. The increase in number of pelagic fishing trips and the fisherman (boats) making pelagic landings (Figure 4) indicate that additional fishermen have entered the fishery. Some of the increase may be attributable to an increase of effort in collecting data for the Commercial Purchase Data Base.

The 1991 CNMI module report suggested that the general decline in number of pelagic fishing trips from 1984 to 1990 is most likely a reflection of the shift from full-time fishing to part-time by many of the better fishermen. This change may be related to more fishermen participating in the lucrative tourist market or local government positions. Although this reasoning is still viable, a closer examination of the Commercial Purchase Data Base, Vessel Inventory Data Base and further discussions with local fishermen may help explain why the number of pelagic trips have been increasing since 1991.

Figure 6. CNMI average inflation-adjusted price -- tunas and other PPMUS.



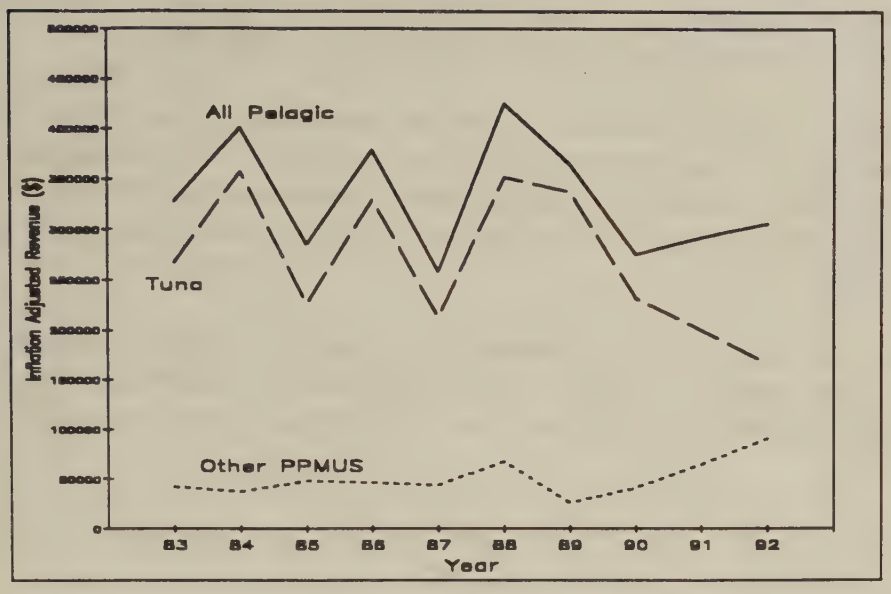
Year	Average Price ($/lb)			
	Tunas		Other PPMUS	
	Unadjusted	Inflation-Adjusted	Unadjusted	Inflation-Adjusted
1983	0.99	1.63	1.12	1.84
1984	0.95	1.44	1.15	1.75
1985	1.02	1.49	1.14	1.66
1986	1.07	1.52	1.22	1.73
1987	1.14	1.55	1.27	1.73
1988	1.20	1.56	1.35	1.76
1989	1.29	1.58	1.48	1.80
1990	1.56	1.83	2.07	2.42
1991	1.80	1.95	1.92	2.07
1992	1.91	1.91	2.01	2.01

Source and Calculation: The unadjusted average price is calculated by dividing the total revenues generated by the total weight sold. The inflation adjustment is made using the 1992 CNMI Consumer Price Index (CPI) as the basis by which calculations of previous years' prices are made. The CPI for 1983-1987 were not available from the appropriate CNMI agency and were, therefore, estimated by using Guam's annual inflation rate to proportionately adjust the 1988 CNMI CPI.

Interpretation: The inflation-adjusted and unadjusted average price of tuna displayed a gradual increase from 1984 until 1990, when a notable rise was observed. Average unadjusted prices continued to increase through 1992, however, a slight decrease was noted for the average inflation-adjusted tuna price in 1992. With the general trend of decreasing skipjack tuna landings in 1991 and 1992, a stable and/or possibly expanding market demand, the average price of tuna should be maintained at a high level.

The inflation-adjusted and unadjusted average price of other PPMUS follow the same general trends as tuna. Also, the average unadjusted price exhibited a slight increase in 1992 while the inflation-adjusted average price decreased.

Figure 7. CNMI annual commercial inflation-adjusted revenues -- all pelagics, tunas, and other PPMUS.



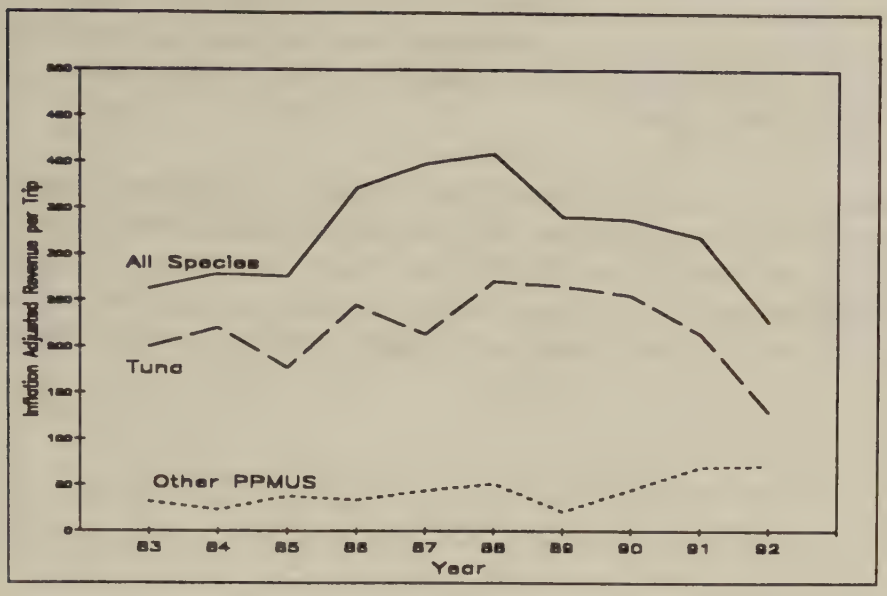
Year	Revenues ($)					
	All Pelagics		Tuna		Other PPMUS	
	Unadjusted	Inflation-Adjusted	Unadjusted	Inflation-Adjusted	Unadjusted	Inflation-Adjusted
1983	198710	327872	162240	267696	25770	42521
1984	264203	401589	235262	357598	24503	37245
1985	195372	285243	155171	226550	33162	48417
1986	267013	379158	231745	329078	32631	46336
1987	190150	258604	156634	213022	32333	43973
1988	327260	425438	270679	351883	51950	67535
1989	299142	364953	276671	337539	21635	26395
1990	235520	275558	198775	232567	34968	40913
1991	271030	292712	185662	200515	60031	64833
1992	305927	305927	166235	166235	90627	90627

Source and Calculation: Annual revenue in dollars is summed separately for all pelagic fish, and for tuna and PPMUS. Inflation-adjusted revenues are calculated using the Consumer Price Index, with 1992 as a base by which previous years' nominal prices are adjusted. The CPI for 1983-1987 were not available from the appropriate CNMI agency and were, therefore, estimated by using Guam's annual inflation rate to proportionately adjust the 1988 CNMI CPI.

Interpretation: Inflation-adjusted revenues for all pelagic species increased slightly in 1992 and did not approach the 1988 record high. Inflation-adjusted revenues for other PPMUS has experienced a steady increase since 1990 and surpassed the 1988 record. In contrast, inflation-adjusted tuna revenues have decreased for the past two years.

The erratic fluctuations of the inflation-adjusted revenues for tuna and for all pelagic species, prior to 1990, is most likely due to the annual variations in skipjack tuna landings (see Figure 3) which dominate the tuna category.

Figure 8. CNMI annual commercial inflation-adjusted revenues for PPMUS trips only -- all species, tunas, and other PPMUS.

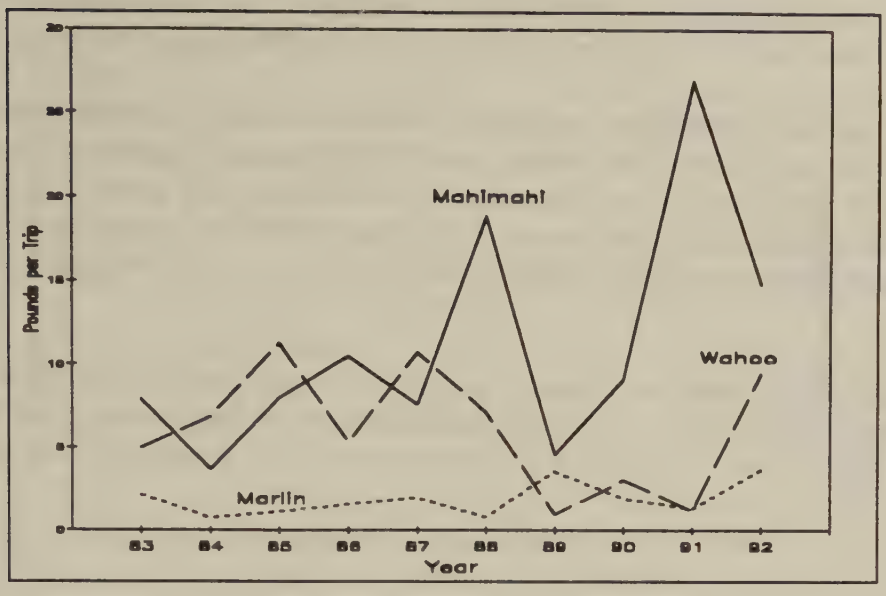


Year	Revenues ($) per PPMUS Trip					
	All Species		Tunas		Other PPMUS	
	Unadjust.	Inflation-Adjusted	Unadjust.	Inflation-Adjusted	Unadjust.	Inflation-Adjusted
1983	159	263	121	200	19	32
1984	183	279	145	221	15	23
1985	189	276	122	178	26	38
1986	262	372	172	245	24	34
1987	292	398	157	214	32	44
1988	315	409	209	271	40	52
1989	279	341	218	266	17	21
1990	289	338	219	256	39	45
1991	295	319	199	215	64	70
1992	228	228	130	130	71	71

Source and Calculation: Values are obtained by selecting, from the Commercial Purchase Data Base, all trips which landed at least one PPMUS, and then calculating (a) the average revenue of all species, (b) the average revenue of other PPMUS only, and c) the average revenue of tuna only. Inflation-adjusted revenues are derived from the CNMI Consumer Price Index (CPI) which used 1992 as a base. The CPI for 1983-1987 were not available from the appropriate CNMI agency and were, therefore, estimated by using Guam's annual inflation rate to proportionately adjust the 1988 CNMI CPI.

Interpretation: The inflation-adjusted revenues for all species per PPMUS trip and for tuna per PPMUS trip has been declining since 1989, while the inflation-adjusted revenues for other PPMUS per PPMUS trip have increased since 1990. The increase in PPMUS inflation-adjusted revenues may indicate an increasing importance of "other PPMUS species" relative to other pelagic species.

Figure 9. CNMI trolling catch rate of mahimahi, wahoo and marlin.



Year	Trolling Catch Rate (lb/trip)		
	Mahimahi	Wahoo	Marlin
1983	7.92	4.98	2.15
1984	3.73	6.90	0.76
1985	8.02	11.29	1.15
1986	10.50	5.35	1.57
1987	7.61	10.73	1.97
1988	18.87	7.17	0.80
1989	4.60	0.99	3.59
1990	9.13	3.04	1.92
1991	26.95	1.21	1.32
1992	14.79	9.47	3.68

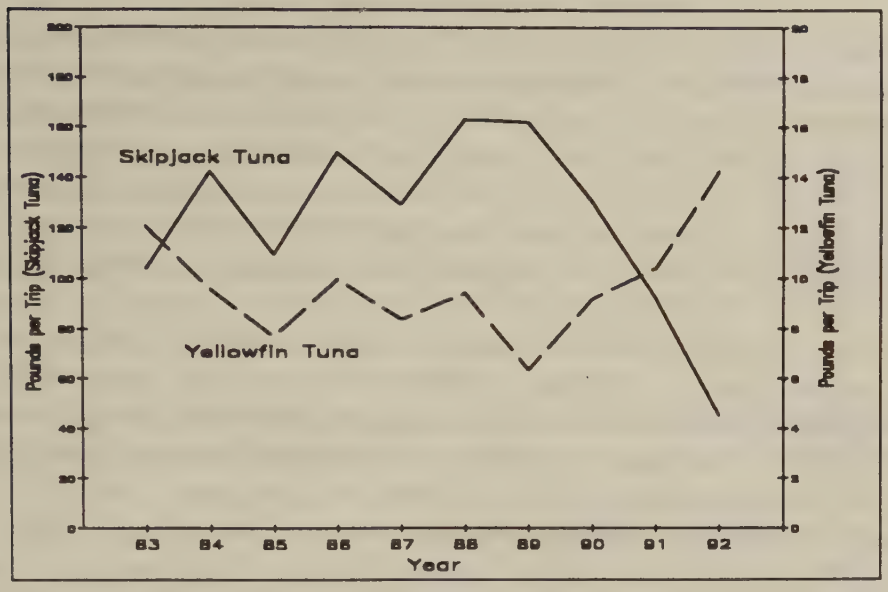
Source and Calculation: Annual catch rates for selected species are obtained by calculating the average weight per trip for each year. Trips are assumed to be one day in length and each invoice represents one trip.

Interpretation: The 1992 mahimahi catch rate decreased substantially from the record high set in 1991. Although the decrease in catch rate is noted, the 1992 rate is still the third highest catch rate on record. The cyclic pattern which appears in the mahimahi catch rate correlates with annual mahimahi landings in Figure 2.

Generally, wahoo catch rates have been declining since 1988 and not until 1992 have catch rates reached the historic pre-1988 levels. The sharp increase in wahoo catch rates follow the increase in wahoo landings shown in Figure 2. Due to the declining skipjack tuna landings, fishing effort may have been shifted to other pelagic species such as wahoo, yellowfin tuna and mahimahi (when in season).

Marlin catch rates, relative to mahimahi and wahoo, are historically low. The highest catch rates occurred during 1989, and have decreased each succeeding year until 1992 when a record high average of 3.71 lb per trip was recorded.

Figure 10. CNMI trolling catch rates of skipjack and yellowfin tuna.



Year	Trolling Catch Rate (lb/trip)	
	Skipjack	Yellowfin
1983	104.21	12.09
1984	142.40	9.59
1985	109.75	7.71
1986	150.07	9.98
1987	129.33	8.37
1988	163.25	9.42
1989	162.08	6.36
1990	130.55	9.20
1991	92.46	10.41
1992	45.47	14.25

Source and Calculation: Data are summarized from the Commercial Purchase Data Base, which provides average pounds caught per trip. Annual catch rates for

selected species are obtained by calculating the average weight per trip for each year. Trips are assumed to be one day in length and each invoice represents one trip.

Interpretation: Catch rates for skipjack tuna have decreased dramatically for the last three years. Previous to the current decline, skipjack tuna had the highest recorded catch rates in 1988 and 1989. Skipjack tuna are the preferred species in the troll fishery of the CNMI because of their relative ease of capture and local popularity. The decline in catch rates for this species parallel declines in total landings (Figure 3). These declines may be related to resource abundance as we are not aware of any change in targeting of this species by local fishermen.

Catch rates for yellowfin tuna increased by 38% in 1992. Catch rate increases were also experienced in 1990 and 1991 (45% and 13% respectively). Yellowfin tuna are not encountered often and are usually taken incidentally while targeting other species. The increases in catch rate for 1992 (and possibly 1991) may be related to the probable shift of fishing effort from skipjack tuna to other pelagic species, due to the lack of skipjack tuna.

Appendix 6

NMFS Publications and Reports

Pelagic Research in 1992[1]

Publications

Boggs, C.H. 1992. Interaction of limited-range fisheries: the example of Hawaii's pelagic fisheries (abstract). 43rd Tuna Conference, University of California Conference Center, Lake Arrowhead, CA, May 18-21, 1992.

Boggs, C.H. 1992. Depth, capture time, and hooked longevity of longline-caught pelagic fish; timing bites fo fish with chips. Fish. Bull. U. S. 90:642-658.

Brill, R.W. 1992. Horizontal and vertical movements of striped marlin, *Tetrapterus audax*, in Hawaiian waters determined using ultrasonic telemetry, with simultaneous measurement of oceanic currents (abstract). 43rd Tuna Conference, University of California Conference Center, Lake Arrowhead, CA, May 18-21, 1992.

Brill, R.W., P.G. Bushnell, D.R. Jones, and M. Shimizu. 1992. Effects of acute temperature change, *in vivo* and *in vitro*, on the acid-base status of blood from yellowfin tuna, *Thunnus albacares*. Can. J. Zool. 10:164-662.

Brill, R.W. and D.R. Jones. 1992. The influence of hematocrit, temperature, and shear rate on the viscosity of blood from a high energy demand teleost, the yellowfin tuna, *Thunnus albacares*. J. Exp. Biol.

Buck, L.T., R.W. Brill, and P.W. Hochachka. 1992. Gluconeogenesis in hepatocrytes isolated from the skipjack tuna, *Katsuwonus pelamis*. Can. J. Zool. 70:1254-1257.

Bushnell, P.G., and R.W. Brill. 1992. Oxygen transport and cardiovascular responses in skipjack tuna, *Katsuwonus pelamis*, and yellowfin tuna, *Thunnus albacares*, exposed to acute hypoxia. J. Comp. Physiol. B. 162:131-143.

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[1] Compiled from NMFS (1993), Director's Report to the 44th Tuna Conference: On tuna and tuna-related activities at the Southwest Fisheries Science Center for the period May 1, 1992 to April 30, 1993. Southwest Fisheries Science Center, La Jolla, Administrative Report LJ-93-05, 41p.

Farrell, A.P., P.S. Davie, C.E. Franklin, J.A. Johansen, and R.W. Brill. 1992. Cardiac physiology in tunas. I. *In vitro* perfused heart preparations from yellowfin and skipjack tunas. Can. J. Zool. 70:1200-1210.

Holland, K.N., R.W. Brill, R.K.C. Chang, J.R. Sibert, and D.A. Fournier. 1992. Physiological and behavioral thermoregulation in bigeye tuna, *Thunnus obesus*. Nature 358:410-412.

Keen, J.E., A.P. Farrell, G.F. Tibbits, and R.W. Brill. 1992. Cardiac physiology in tunas. II. Effect of ryanodine, calcium, and adrenaline on force-frequency relationships in atrial strips from skipjack tuna, *Katsuwonus pelamis*. Can. J. Zool. 70:1211-1217.

Mathieu-Costello, O.A., P.J. Agey, R.B. Lodgemann, R.W. Brill, and P.W. Hochachka. 1992. Capillary-fiber geometrical relationships in tuna red muscle. Can. J. Zool. 70:1218-1229.

Moyes, C.D., O.A. Mathieu-Costello, R.W. Brill, and P.W. Hochachka. 1992. Mitochondrial metabolism of cardiac and skeletal muscles from a fast *Katsuwonus pelamis* and a slow *Cyprinus carpio* fish. Can. J. Zool. 70:1246-1253.

Skillman, R.A., and G.H. Balazs. 1992. Leatherback turtle captured by ingestion of squid bait on swordfish longline. Fish. Bull. U. S. 90:807-808.

Tibbits, G.F., H. Kashihara, and R.W. Brill. 1992. Myocardial sarcolemma isolated from skipjack tuna, *Katsuwonus pelamis*. Can. J. Zool. 70:1240-1245.

Watson, C.L., H.A. Morrow, and R.W. Brill. 1992. Proteolysis of skeletal muscle in yellowfin tuna, *Thunnus albacares*: evidence of calpain activation. Comp. Biochem. Physiol. 103B(4):881-887.

Manuscripts Approved for Publication by NMSSWFSC

Boggs, C.H. In press. Methods for analyzing interactions of limited-range fisheries: Hawaii's pelagic fisheries. FAO Expert Consultation on Interactions of Pacific Tuna Fisheries.

Boggs, C.H., and R.Y. Ito. In press. Hawaii's pelagic fisheries. Mar. Fish. Rev.

Boggs, C.H., and B.S. Kikkawa. In press. The development and decline of Hawaii's skipjack tuna fishery. Mar. Fish. Rev.

Brill, R.W., and D.B. Holts. in press. Effects of entanglement in high-seas driftnets on the relative fitness of North Pacific albacore, *Thunnus alalunga*, recaptured by troll gear. Fish. Bull. U. S.

Brill, R.W., D.B. Holts, R.K.C. Chang, S. Sullivan, H. Dewar, and F.G. Carey. in press. Horizontal and vertical movements of striped marlin, *Tetrapterus audax*, near the Hawaiian Islands based on ultrasonic telemetry with simultaneous measurement of oceanic currents. Mar. Biol.

Jones, R.D., R.W. Brill, and P.G. Bushnell. In press. Ventricular and arterial dynamics of anaesthetized and swimming tuna. J. Exp. Biol.

Pooley, S.G. In press. Economics and Hawaii's marine fisheries. Mar. Fish. Rev.

Townsend, R.E., and S.G. Pooley. In press. Application of fractional licensing in the Hawaii longline fleet. N. Am. J. Fish. Mgmt.

Administrative Reports

Bartoo, N., D. Holts, and L. Halko. 1992. Report on the 1991 cooperative North Pacific albacore observer project. SWFSC Admin. Rep., La Jolla, LJ-92-16, 14 p.

Dollar, R.A. 1992. Annual report of the 1991 western Pacific longline fishery. SWFSC Admin. Rep., Honolulu, H-92-11, 67p.

Hamm, D.C., and H.K. Lum. 1992. Preliminary results of the Hawaii small-boat fisheries survey. SWFSC Admin. Rep., Honolulu, H-92-08, 35 p.

Hamm, D.C., M.M.C. Quach, and R.S. Antonio. 1992. Fishery statistics of the western Pacific, Volume VIII. SWFSC Admin. Rep., Honolulu, H-92-14, var. pg.

Ito, R.Y. 1992. Western Pacific pelagic fisheries in 1991. SWFSC Admin. Rep., Honolulu, H-92-15, 38 p.

Rensink, G. 1992. Summary of the 1990-91 U. S. South Pacific albacore fisheries data. SWFSC Admin Rep., La Jolla, LJ-92-11, 22 p.

Skillman, R.A., and G.L. Kamer. 1992. A correlation analysis of Hawaii and foreign fishery statistics for billfishes, mahimahi, wahoo, and pelagic sharks, 1962-1978. SWFSC Admin. Rep., Honolulu, H-92-05, 33 p.

Tsuji, S., H. Nakano, and N. Bartoo. 1992. Report of the 12th North Pacific Albacore Workshop, Shimizu, Japan, July 23-25, 1991. SWFSC Admin. Rep., La Jolla, LJ-92-04, 15 p.